SIMPLIFIED

STELLAR MAPS

AND

ASPECTS OF THE NIGHT SKY

CHIEFLY FOR USE IN LATITUDE 20° N.

A SERIES OF MONTHLY AND GENERAL STAR MAPS WITH A BRIEF EXPLANATORY INTRODUCTION AND DESCRIPTIVE ACCOUNT OF THE NIGHT SKY FOR EACH MONTH OF THE YEAR AS ALSO A SUMMARY OF ASTRONOMICAL TERMS IN COMMON USE

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PREPARED BY

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&c.

Nos. I to XII
Monthly Star Charts for Latitude 20° N.
Nos. XIII to XIV
General Star Charts for Latitude 0°
Nos. A to C
Specimen Monthly and Annual Maps.

SECOND EDITION

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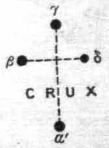
Nocturnal Observations in the Far East.

SIMPLIFIED STELLAR MAPS AND ASPECTS OF THE NIGHT SKY



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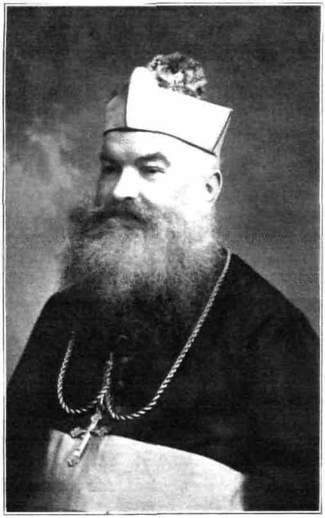

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BISHOP OF LIMYRA AND

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WHOSE PIETY AND SPIRITUAL ZEAL ARE BEYOND

ALL PRAISE

" What though, nor real voice nor sound
Amid their radiant orbs be found;
In reason's ear they all rejoice,
And utter forth a glorious voice;
For ever singing as they shine,
The Hand that made us is Divine.'

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Preface.

THIS work was originally prepared in Cork, in 1914, as the result of a series of exceptionally well-executed zinco-blocks of monthly Star Maps designed to accompany astronomical articles for Newspapers. Only a limited number of copies were printed at the time, which were intended for private circulation alone. But it was since considered that the public should also receive the benefit of the issue, hence the present venture. Even now, only a comparatively small number of copies have been printed, owing to the prevalent high cost of publication.

The previous matter of the text has been expanded somewhat on this occasion, and a summary of astronomical terms in common use added, which should be found useful. The over-printing, in colour, of meridians and parallels on the Maps, is a new feature. The text itself, as it now appears, has been printed, and the binding done, in Bombay; while the Illustrations were impressed, from zinco-blocks executed there, in London. The final proofs of the letter-press have been personally examined and passed by the undersigned.

Any suggestions for future editions of the book will be thankfully received.

J. C. C.

BOMBAY, 1st *January* 1922.

ERRATA ET CORRIGENDA

"*Simplified Stellar Maps*"

Book List.

P. ii, line 14, *for* "Com-" *read* "com-".

Dedication.

P. v, line 6, *for* "ÉTRANGÉRES" *read* "ÉTRANGÈRES".

Contents.

P. 1, right column, last line, *for* "vi" *read* "65".

Preface.

P: 2, line 8, *after* "left" *insert* a *comma* (,).

P. 2, line 12, *after* "useful." *insert* "The subject concerning the aspects of the night sky is an addition."

P. 2, line 13, *after* "feature." *insert* "The entire production—text, glossary, and maps—is, designedly, of a purely practical character, and inherently self-contained."

Introduction.

P. 5, line 2 from bottom, *after* "meridian" *introduce* a *comma* (,).

P. 12, line 4 from bottom, *after* "clear" *insert* a *comma* (,).

P. 14, below line 4, at left top of Diagram, *insert* "FIG. III."

P. 14, last line, *after* "Gemini." *add* "The Moon's position, when Full (on 20th), is at the point M (Long. 263°, not apparent in Sketch), on the far side of the Earth, away from the Sun ; her place is in Scorpius."

P. 15, line 6, *after* "December" *insert* ", in their middle".

P. 15, line 12, *before* "occurs" *insert* "of Venus".

P. 15, line 13, *for* "before" and "after" *substitute* "*before*" and "*after*".

P. 15, line 13, *after* "conjunction" *insert* "; or, 35 days *after* its Eastern or *before* its Western elongation".

Night Sky.

P. 18, line 18 from bottom, *after* "zenith" *insert* "; the apparent divergent motions of meteors are merely the effect of perspective".

P. 19, lines 14 and 13 from bottom, *delete* "(the Foot of the Giant)".

P. 22, line 10, *before* "is" *insert* ", from its position sometimes called Cor Leonis (the Lion's Heart),".

P. 23, line 14 from bottom, *for* " 20′′ " *read* " 20° ".

P. 23, line 13 from bottom, *for* " ship " *substitute* " Ship ".

P. 25, lines 8 and 9, *after* " (local time) " *insert*; " its altitude in that position about corresponds with the elevation of the pole, which equals the latitude of the place; ε Ursæ Majoris is then some 6 hours E. of the meridian. "

P. 25, line 10 from bottom, *after* " (the Sextant) " *insert* a *comma* (,).

P. 29, line 19 from bottom, *after* " 10 p.m. " *insert* " (local time) ".

P. 30, line 11 from bottom, *after* " 9 p.m. " *insert* " (local time) ".

P. 32, line 5, *after* " Vega," *insert* " W.S.W.,".

P. 32, line 5, *after* " second," *insert* " at right angles to the line of sight,".

P. 32, line 12 from bottom, *for* the *comma* (,) following " us " *substitute* a *semi-colon* (;).

P. 33, line 21 from bottom, *for* the *comma* (,) after " Earth " *put* a *semi-colon* (;).

P. 37, line 6 from bottom, *after* " (local time) " *insert* " ; its altitude in that position about corresponds with the elevation of the pole, which equals the latitude of the place; ε Ursæ Majoris is then some 6 hours W. of the meridian ".

P. 38, line 3, *after* " latter " *insert* " , also known as Cor Scorpionis (the Heart of the Scorpion) , ".

P. 41, line 2 from bottom, *before* " Arietids " *insert* " ε ".

Astronomical Terms.

P. 42, line 7, *for* " sun rise " *read* " sun-rise ".

P. 45, line 14, *after* " sun " *insert* "(= 1 astronomical unit) ".

P. 50, line 17, *delete* the second " is ".

P. 53, line 8, *for* " s " *read* " is ".

P. 54, line 8 from bottom, *for* " Shorter " *read* " shorter ".

P. 55, line 4, *after* " be " *place* a *comma* (,).

P. 55, *above* line 9 from bottom, *introduce* :

" *Sky.*—See *Heavens.* [Sky-blue : the result of light scattered laterally from minute particles in the air]."

Maps.

P. II, last line, at bottom, *after* " P.M. " *close* the bracket.

P. XIII, last line, at bottom, *after* " P.M." *close* the bracket.

Appendix.

P. 65, *below* line 2, *insert* " (*Founded on fact*).".

☞ **It is particularly requested that notice of any errors discovered in the present edition (2nd) of the " Simplified Stellar Maps " may be promptly sent to the Author, C/o Messrs. Thos. Cook & Son, Hornby Road, P.O. Box 46, Bombay (India).**

Preface.

P. 2, line 13, in the addition, *after* "self-contained" *insert* "; An exhaustive Index has been inserted at the end, for convenience of reference."

Night Sky.

P. 16, line 7 from bottom, *before* "would" *insert* a *comma* (,).

P. 17, line 22, *for* "Cassiopeia" *read* "Cassiopeiæ".

P. 19, line 11 from bottom, *after* "Times" *insert* a *comma* (,).

P. 19, line 10 from bottom, *before* "have" *insert* a *comma* (,).

P. 21, line 8, *after* "left" *insert* a *comma* (,).

P. 22, lines 14 and 15, *transfer* the para "The * * Sirius" to *below* line 24 on p. 23.

P. 31, last line, *after* "double" *add* "Some 15° S. W. of the tail star, η, is seen the interesting star (unnamed on Map) of Cor Caroli (Charles' Heart), of the 3rd magnitude."

P. 36, last line, *for* "15th" *put* "20th".

Introduction.

The Star Maps have been specially devised for use in India and Burma. They consist of a series of twelve monthly Charts, Nos. I to XII, for latitude 20° N.; and two general Charts, Nos. XIII and XIV, for latitude 0°. The projection of the first set is geometrical (*see* Fig. I), and of the second globular (*see* Fig. II).

Fig. I.

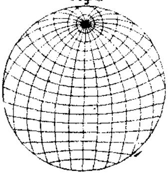
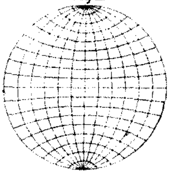


Fig. II.



MAPS Nos. I to XIV.

The Maps furnish a comprehensive view of the Sky, in the regions to which they apply, for the periods represented by them. The chief features are brought prominently forward, out of a more distant background, as in a landscape perspective. Nos. I to XII show the exact appearance of the Constellations, as seen from a position of latitude 20° N., at the moment the central Hour Circle forms the local meridian, at about 9-30 p.m. (or 21h. 30m., local mean solar time) on the 1st of the month, 9 p.m. (or 21h. 0m.) on the 8th, 8-30 p.m. (or 20h. 30m.) on the 15th, 8 p.m. (or 20h. 0m.) on the 22nd, and 7-30 p.m. (or 19h. 30m.) on the last day; for intermediate dates, the time values are readily interpolated. Earlier than the times named, on the stated dates, stars seen near the eastern horizon will not have risen, and later those towards the western horizon will have set. In higher latitudes than 20° N., the meridian altitude of the N. Pole will proportionately increase, and in lower latitudes similarly decrease; and in that measure, also, the northern and southern skies will expand or contract. Nos. XIII and XIV exhibit one-half of the heavens as if viewed from mid-

way on the celestial equator along the summer and winter solstitial colures, and bounded by the great circle which passes through the equinoctial points; they represent the N. and S. Ecliptic hemispheres, and would be true in outline, as they stand, for the 22nd February and 22nd August, at the time (local) of 8 p.m. (or 20h. 0m.). Stars rise and set nearly 4 minutes *earlier each night*; their apparent direction of motion is from east to west *above* the poles, and from west to east, for circumpolar stars, *below* the poles.

The apparent course of the Sun among the stars is represented by the line of the Ecliptic, though the orb itself will, of course, be invisible in the night sky. Its monthly periods are duly marked, in sections; thus, in Maps XIII and XIV, the Sun will be on the local meridian about noon on the 21st June and 21st December, respectively. The N. and S. Poles of the Ecliptic lie in the Constellations Draco and Dorado; the former in R. A. 18h. 0m., Dec. 66° 33′ N., and the latter in R.A. 6h. 0m., Dec. 66°33′ S.

The Viâ Lactea (Milky Way), which is composed of innumerable minute stars, and the Galactic Poles are also projected on the Maps. The N. and S. Poles of the Galaxy, or Galactic Belt, are situated at the opposite sides of the celestial sphere in the constellations of Coma Berenices and Sculptor; in R. A. 12h. 30m., Dec. 27° N., and in R. A. 0h. 30m., Dec. 27° S., respectively. Around these points the stars are more thinly scattered than in any other directions; whilst the densest formations are contained in the luminous zone traversed by the great circle at right angles to the diameter joining these points, denominated the Galactic Circle. This circle intersects the celestial equator at two points situate 10° east of the equinoctial points, and is inclined to the Equator at an angle of 63°, and therefore to the Ecliptic at an angle of 40°. In referring the distribution of the stars over the celestial equator, it is convenient to refer them to this circle and its poles. The distance of the different points of the firmament from the Galactic Circle, in either hemisphere, may be expressed by the terms N. or S. Galactic Latitude.

For use, the Maps should be held upright facing the direction (denoted at the bottom) in which the sky is viewed, when the constellations of that part of the heavens will be presented to the eye. The centre of the Maps, denoted by a cross in Nos. I to XII, represents the zenith; and the circular boundary the horizon, with the principal points of the compass indicated. The projection used is such that the distance of each star from the centre

of the Map is proportional to the star's zenith distance; while the angle which the line joining a star to the zenith makes with the central meridian is the azimuth of the star. As the celestial sphere is viewed from the inside, the cardinal points are not disposed on these Maps as in a terrestrial atlas; so that when the north is at the top, the west will be on the right, and the east on the left. In Nos. XIII and XIV the celestial meridians, or declination circles, against the months shown on the Maps, pass through the zenith at the hour (local) of about 8 p.m. (or 20h. 0m.). For the latitude of 0°, the zenith would be at the intersection of the Hour Circle with the Equator, and for the latitude of 20° N., at the intersection of the Hour Circle with the 20° N. Parallel; in the latter case the portion of the sky from the 70° S. Parallel to the South Pole would be invisible, while the visible portion of the sky from the North Pole down to the 70° N. Parallel on the far side (*i.e.*, to the limit of the horizon at the north end) would appear on the Maps. Dotted lines are drawn through the stars showing the chief features of each constellation, to assist in the identification of the different groups of stars visible in the heavens. The imaginary boundaries of the constellations are not shown, in addition, as they would only tend to confuse the picture and distract the imagination, and be of no real practical value, besides. The N. and S. celestial poles, whence the declination circles diverge, are near the Pole stars; in the case of Nos. I to XII by α Ursæ Minoris (*Polaris*, Mag. 2·1, R. A. 1h. 29m., Dec. 88° 51′ N.), and in that of Nos. XIII and XIV also by σ Octantis (Mag. 5·5, R. A. 19h. 25m., Dec. 89° 14′ S.). The Ecliptic and Equinoctial are depicted by firm lines, and the writing is made to face the centre of the Maps for convenience of reading the names from any direction on the boundary line. The Roman numerals indicating hour circles in the Maps represent sidereal (or star) time.

Should the Maps be required for use at earlier or later hours than for which constructed, the Hour Circles would, if the maps were considered as globes revolving round their common axis, require to be shifted towards the E. or W., as the case may be, just as many hours (an hour being equivalent to one-twelfth of the semi-circumference of the Map) from the said time, as desired. Half an hour or so on either side of the stated times, corresponding to the instant when the central Hour Circle constitutes the local meridian will suffice for the purpose of identifying the stars, only if *later* than the hour

named the stars in the eastern quarter of the sky will be a little ***higher*** up and those in the western quarter a little *lower* down than is represented on the Map, and *vice versâ* if the time is *earlier* than that stated.

The *following statement* shows at a glance the Map that should be used *in* the middle of each month at different hours (local time) of the night, for all latitudes from 10° to 30° N., and all longitudes:—

MONTH AND MAP.

Hour.	Nov.	Dec.	Jan.	Feb.	Mar.	Apl.	May.	Jun.	Jul.	Aug.	Sep.	Oct.
4–30 p.m. (or 16h. 30m.) .	XI	XII	I	II	III	IV	V	VI	VII	VIII	IX	X
6–30 p.m. (or 18h. 30m.) .	XII	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
8–30 p.m. (or 20h. 30m.) .	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
10–30 p.m. (or 22h. 30m.) .	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I
0–30 a.m. (or 0h. 30m.) .	III	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II
2–30 a.m. (or 2h. 30m.) .	IV	V	VI	VII	VIII	IX	X	XI	XII	I	II	III
4–30 a.m. (or 4h. 30m.) .	V	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV
6–30 a.m. (or 6h. 30m.) .	VI	VII	VIII	IX	X	XI	XII	I	II	III	IV	V

For general convenience, however, there is recorded at the foot of each Map the exact time (local mean solar) at which the central Hour Circle (sidereal) comes upon the meridian on the 1st, 8th, 15th, 22nd, and the last day of the month (calendar), for a longitude of 90°, or 6h. E.; for intermediate dates, the values may be obtained by simple estimation. For other places, up to 15°, or 1h., on either side of this position, the values would be practically identical with those given. The time values are the average of four successive years (mean solar, 1918-1921), and would thus be true, to within a minute for any year (calendar). Outside of the standard meridian (of 5½ hours for India, or 6½ hours for Burma), local time can be converted into standard by applying a correction, – (when E.) or + (when W.), equal to the difference of longitude (in time) between the two places.

To avoid congestion, the meridians of Right Ascension and the parallels of Declination, other than the central Hour Circle and the 70° Parallels, and the Equinoctial, are omitted, in black, on the Maps; though shown as superposed blue-prints. Their positions, however, on the Celestial Equator and on the Hour and Boundary (Horizon) lines, are respectively denoted by Roman and Arabic numbers. For the same reason, the names of only the 1st and 2nd magnitude stars, or those of special interest, are retained; and the Greek letters or figures for the others are left out. The Maps

show the stars of the first four magnitudes, according to size ; with some exceptions, the smaller and faint ones are, to prevent confusion, not depicted, but where projected they are made to appear proportionately smaller. Nautical Almanac stars are shown by black dots, and others by rings.

MAPS Nos. A to C.

The positions of the Moon and the paths of the Planets, in relation to the stars, are not plotted on the Maps, as these continually change ; but they are readily charted, if required, from the elements of Right Ascension and Declination to be found in any Astronomical Almanac. There are separate monthly and annual Maps to exhibit the varying phases ; specimens, Nos. A to C, are provided at the end of the brochure. In No. A, the positions of the Moon (indicated by a small circle enclosing the date) and Planets in the month are relative to the stars, at the moment the central Hour Circle (4 Hours) forms the local meridian. The Moon appears on the Map from the 1st to the 4th, and again from the 18th to the 31st ; on other evenings she is below the horizon at the hour indicated by the places of the stars ; its conventional phases are not delineated, owing to the diminutive scale of the diagram. In Nos. B to C, the positions of the Moon at full and of the Planets during the year are relative to the stars at the moment the central Hour Circle for the time being (*e.g.*, 6 Hours in February, 8 Hours in March, etc., 18 Hours in August, 20 Hours in September, etc.), forms the local meridian ; in this way their places will coincide with those they will occupy in the Monthly Star Charts. The Moon's places are indicated by a small circle enclosing the month to which it refers. The apparent paths of the Planets are shown by broken lines for Mercury and Venus, and by dot and dash for the others whose arcs are shorter. These orbits, without exception, lie in the neighbourhood of the Ecliptic, and for the most part the movements of the Planets are in the direction (W. to E.) of the zodiacal signs in the order in which the Sun traverses them. The motions of the Planets among the stars are *direct* (*i.e.*, eastward), except between their stationary points at inferior conjunction in the case of inferior Planets, and at opposition in the case of superior Planets, when for a time they become *retrograde* (*i.e.*, westward).

For more detail concerning celestial observations, the fuller work entitled "Star Charts" would require to be consulted ; and for practical astronomy, the large "Aid to Land-Surveying."

ASPECTS OF THE NIGHT SKY.

Preceding the Stellar Maps is a short descriptive account of the night sky for each month of the year, appertaining to Maps I to XII. This relates mostly to the positions occupied by the chief stars, which form the most attractive and useful features of the celestial firmament, and being of a practical type, should prove of special interest to nocturnal observers. Concurrently with that fact there will be brought before the mind a manifest truth, of the existence of a Divinity that rules and guides the Universe —a *system* which moves in such wonderful order and with such astonishing regularity and precision. The Notes also contain brief remarks relating to the principal meteoric showers (if any) of the month. The Monthly Maps give the aspect of the starry sphere for all meridians at the previously stated *local* times, which may be converted into standard by the ordinary precept. Those times, it may be noted, are reckoned in accordance with both the old double twelve-hour method, and the new single twenty-four-hour method ; and where the solar day, in each case, is taken to commence at midnight. The zodiacal constellations (in groups of three) associated with winter, spring, summer and autumn are specified in the Notes for December, March, June and September; these, for the particular period, appear in the eastern hemisphere in the early evening and have their approximate centres on the meridian (N. or S., but mostly S., for a position of Lat. 20° N.) at *midnight* in their respective seasons.

GENERAL.

Stars are divided into classes or magnitudes, according to their degree of apparent *brightness*. There are about twenty which belong to the first magnitude, about sixty to the second magnitude, and about two hundred to the third magnitude. The stars of the first magnitude are nearly equally divided between the northern and southern celestial hemispheres. The number of stars of all magnitudes visible to the naked eye is about 6,000, and as we can only see one-half of the sky at once, the greatest number that are visible in the sphere of observation at any one time is 3,000. Some of the stars are brighter than the first magnitude. The unit of measurement is assumed at 1·0, and the numbers representing magnitude increase with diminishing brightness. Stars that

are brighter than the unit by over 1 magnitude, or 0 of the standard are indicated by a *minus* sign. Intermediate stages of brightness are also recognized. Each magnitude is about 2½ times as bright as the magnitude below it. A standard first magnitude star is about 2½ times brighter than a second magnitude star, and exactly 100 times as bright as a sixth magnitude star, the faintest visible to the naked eye. Sirius (α Canis Majoris, mag.—1·6), or the "Dog Star," is the brightest star in the heavens, and next in order of brightness is Canopus (α Argûs, mag.—0·9). Altair (α Aquilæ, mag. 0·9) may be taken as a normal first magnitude star, and Dubhe (α Ursæ Majoris, mag. 2·0), Sulaphat (γ Lyræ, mag. 3·3), and γ Herculis (mag. 3·8), respectively, as average second, third and fourth magnitude stars. Stars should not be observed, for angular work, to within 10° of the horizon, owing to refraction being greatest low down.

The following is a list of the principal Stars of the first and second magnitudes, and of some smaller ones of special value. Their Arabic names, with the corresponding Greek letters of each Constellation, on the Bayer system (introduced in the year 1603), are also given :—

Name.	Mag.	Name.	Mag.	Name.	Mag.
α Andromedæ (*Alpherat*)	2·2	β Geminorum (*Pollux*)	1·2	β Persei (*Algol*)	2·1-3·2
α Aquilæ (*Altair*)	0·9	α Hydræ (*Al Fard*)	2·2	α Piscis Australis	
α Argûs (*Canopus*)	—0·9	α Leonis (*Regulus*)	1·3	(*Fomalhaut*)	1·3
α Aurigæ (*Capella*)	0·2	β Leonis (*Denebola*)	2·2	α Scorpii (*Antares*)	1·3
α Boötis (*Arcturus*)	0·2	α Lyræ (*Vega*)	0·1	α Tauri (*Aldebaran*)	1·1
α Canis Majoris (*Sirius*)	—1·6	α Orionis (*Betelgeuse*)	1·0-1·4	η Tauri (*Pleiades*)	3·0
α Canis Minoris (*Procyon*)	0·5	β Orionis (*Rigel*)	0·3	α Ursæ Majoris (*Dubhe*)	2·0
ο Ceti (*Mira*)	2·9	γ Orionis (*Bellatrix*)	1·7	ε Ursæ Majoris (*Alioth*)	1·7
α Coronæ (*Alphecca*)	2·3	α Pegasi (*Markab*)	2·6	α Ursæ Minoris (*Polaris*)	2·1
α Cygni (*Deneb*)	1·3	β Pegasi (*Scheat*)	2·2-2·7	α Virginis (*Spica*)	1·2
α Eridani (*Achernar*)	0·6	γ Pegasi (*Algenib*)	2·9		
α² Geminorum (*Castor*)	2·0	α Persei (*Mirfak*)	1·9		

For ready reference, the names of the Constellations and Planets, with a short account of the latter, as also the names of the Greek alphabet, are given below; these are followed by a list of astronomical signs and abbreviations.

The Oldest Known Constellations.

Zodiacal Constellations.

Name.	Meaning.	Symbol.	Name.	Meaning.	Symbol.
Aries	*The Ram.*	♈	Libra	*The Balance.*	♎
Taurus	*The Bull.*	♉	Scorpio	*The Scorpion.*	♏
Gemini	*The Twins.*	♊	Sagittarius	*The Archer.*	♐
Cancer	*The Crab.*	♋	Capricornus	*The Sea-Goat.*	♑
Leo	*The Lion.*	♌	Aquarius	*The Water-Bearer.*	♒
Virgo	*The Virgin.*	♍	Pisces	*The Fishes.*	♓

Northern Constellations.

Name.	Meaning.	Name.	Meaning.
Andromeda	*The Chained Lady.*	Hercules	*The Kneeling Man.*
Aquila	*The Eagle.*	Lyra	*The Harp.*
Auriga	*The Charioteer.*	Ophiuchus	*The Serpent-Bearer.*
Boötes	*The Herdsman.*	Pegasus	*The Flying Horse.*
Cassiopeia	*The Lady in her Chair.*	Perseus	*The Rescuer.*
Cepheus	*King Cepheus.*	Sagitta	*The Arrow.*
Corona Borealis	*The Northern Crown.*	Serpens	*The Serpent.*
Cygnus	*The Swan.*	Triangulum (Borealis)	*The Triangle (Northern)*
Delphinus	*The Dolphin.*		
Draco	*The Dragon.*	Ursa Major	*The Great Bear (The Plough).*
Equuleus	*The Little Horse.*	Ursa Minor	*The Little Bear.*

Southern Constellations.

Name.	Meaning.	Name.	Meaning.
Ara	*The Altar.*	Crater	*The Cup.*
Argo	*The Ship Argo.*	Eridanus	*The River.*
Canis Major	*The Great Dog.*	Hydra	*The Snake.*
Canis Minor	*The Little Dog.*	Lepus	*The Hare.*
Centaurus	*The Centaur.*	Lupus	*The Wolf.*
Cetus	*The Sea Monster.*	Orion	*The Hunter.*
Corona Australis	*The Southern Crown.*	Piscis Australis	*The Southern Fish.*
Corvus	*The Crow.*		

THE MODERN CONSTELLATIONS.

Northern Constellations.

Name.	Meaning.	Name.	Meaning.
Camelopardalis	*The Giraffe.*	Leo Minor	*The Lesser Lion.*
Canes Venatici	*The Greyhounds.*	Lynx	*The Lynx.*
Coma Berenices	*The Hair of Berenice.*	Monoceros	*The Unicorn.*
		Vulpecula (Vulp. et Anser)	*The Fox and the Goose.*
Lacerta	*The Lizard.*		

Southern Constellations.

Name.	Meaning.	Name.	Meaning.
Antlia (Pneumatica)	*The Air-Pump.*	Octans (Hadleianus)	*Hadley's Octant.*
Apus	*The Bird of Paradise.*	Pavo	*The Peacock.*
Carina Argo Navis	*The Keel of the Ship Argo.*	Phœnix	*The Phœnix.*
Chamæleon	*The Chameleon.*	Pixis Nautica	*The Mariner's Compass.*
Circinus	*The Compass.*		
Cælum (Cæla Scalptoris)	*The Sculptor's Tools.*	Puppis Argo Navis	*The Poop of the Ship Argo.*
Columba (Noachi)	*Noah's Dove.*	Reticulum (Reticulus Rhomboidalis)	*The Rhomboidal Net.*
Crux	*The Cross.*		
Dorado	*The Sword Fish.*		
Fornax (Chemica)	*The Chemical Furnace.*	Sculptor (Apparatus Sculptoris)	*The Sculptor's Workshop.*
Grus	*The Crane.*		
Horologium	*The Clock.*	Sextans (Uraniæ)	*The Sextant of Urania.*
Hydrus	*The Water-Snake.*		
Indus	*The Indian.*	Telescopium	*The Telescope.*
Malus Argo Navis	*The Mast of the Ship Argo.*	Toucan	*The Toucan (American Goose).*
Mensa (Mons Mensæ)	*Table Mountain.*	Triangulum Australis	*The Southern Triangle.*
Microscopium	*The Microscope.*	Vela Argo Navis	*The Sails of the Ship Argo.*
Musca (Apis Musca Australis)	*The Bee, or Fly.*	Volans (Piscis Volans)	*The Flying Fish.*
Norma (or Quadra Euclidis)	*The Rule, or Euclid's Square.*		

The *Constellations of the Zodiac* which will approximately be on the neridian at midnight of the successive months of the year are given in the subjoined table. Before midnight they will appear to the east, and after it :o the west, of the meridian during the months shown against each:—

Constellation.		Month.	Map.	Constellation.		Month.	Map.
Gemini	..	January	IV.	Sagittarius	..	July	X.
Cancer	..	February	V.	Capricornus	..	August	XI.
Leo	..	March	VI.	Aquarius	..	September	XII.
Virgo	..	April	VII.	Pisces	..	October	I.
Libra	.	May	VIII.	Aries	..	November	II.
Scorpius	..	June	IX.	Taurus	..	December	III.

The sun enters the *Signs of the Zodiac* about the 21st day of each nonth, as follows :—

Sign.		Month.	Map.	Sign.		Month.	Map.
Aries	..	March	I.	Libra	..	September	VII.
Taurus	..	April	II.	Scorpio	..	October	VIII.
Gemini	..	May	III.	Sagittarius	..	November	IX.
Cancer	..	June	IV.	Capricornus	..	December	X.
Leo	..	July	V.	Aquarius	..	January	XI.
Virgo	..	August	VI.	Pisces	..	February	XII.

The Planets.

The Planets are celestial bodies of the solar system which revolve in regular orbits about the sun. They were known, though non-astral, as 'wandering stars' to the ancients, because their apparent movements were complicated and irregular. The orbits of all planets are ellipses, with the sun in one focus. Planets are readily distinguishable from stars, as the former, which are cold bodies, are usually large and shine with a steady light by reflection from the sun, while the latter, which are hot bodies, are generally smaller and are self-luminous, *i.e.*, shine by their own light, and twinkle, or scintillate. Planets shine with a softer light than the stars; they also show a disc when magnified, whereas the stars are so far distant that they appear as points only, even when viewed through the most powerful telescope.

The large planets are eight in number: Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus and Neptune. Venus is the most brilliant of the planets, and shines with a clear steady light; she is known as a morning or evening star when not far from the sun, *i.e.*, rising shortly before or setting soon after the sun. Mercury when favourably situated shines as a brilliant star, and, like Venus, can only be seen as a morning or evening star, and never at

midnight. Jupiter is the largest planet and shines with a bright, clear light, and when at a good distance from the sun is seen near the south at midnight. Mars appears like a very red and bright star, and is ringed. Saturn is of a dullish green colour. Uranus and Neptune are the most distant planets.

Mercury and Venus are *inferior* planets. Mars, Jupiter, Saturn, Uranus and Neptune are *superior* planets. The former are in *inferior* conjunction when between the earth and the sun, and in *superior* conjunction when away from the sun (*i.e.*, with the sun between the earth and planet); the latter are in *conjunction* when the sun is between the earth and planet and in *opposition* when the earth is between the sun and planet. A superior planet is best seen and observed about the time of opposition; it rises and sets nearly at the same time as the sun at conjunction, and is thus invisible then. An inferior planet is for a time invisible when at inferior conjunction, owing to the planet's enlightened hemisphere being turned away from the earth, and is for some time invisible when at superior conjunction, owing to its proximity to the sun's rays. A planet souths about noon when in conjunction and about midnight when in opposition. It is in the *ascending* or *descending node*, according as it crosses the ecliptic from S. to N. or from N. to S. The earth and planets have the form of an oblate spheroid by reason of a centrifugal force.

The mean, as also the least and greatest, distances of the planets from the sun, their average sidereal periods of revolution, their magnitudes as compared with the earth, and their mean velocities per second are as follows:—

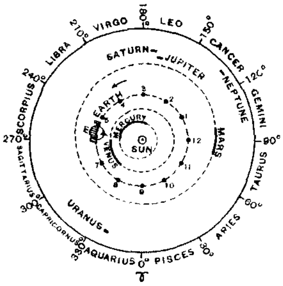
Planet.		Mean *distance* (In Millions of Miles)	*Period* (Years and Days).		Diameter (Earth = 1).	*Velocity* per second (Miles).	Least *distance* (In Millions of Miles).	Greatest *distance* (In Millions of Miles).
Mercury	..	36	0	88	0·37	29	28½	43½
Venus	..	67	0	225	0·99	21·7	66½	67½
Earth	..	93	0	365¼	1·0	18	91½	94½
Mars	..	142	1	322	0·53	14·9	128½	154½
Jupiter	..	483	11	315	11·1	8	459	507
Saturn	..	886	29	167	9·3	6·2	838	934
Uranus	..	1,782	84	7	4·2	4·3	1,699	1,865
Neptune	..	2,791	164	280	3·8	3·1	2,767	2,816

[The least and greatest distances of Mercury and Venus from the Earth, in millions of miles, are: Mercury, least = 58, greatest = 133; Venus, least = 26, greatest = 160].

Planetary Diagram.

Fig. III shows the heliocentric positions of all the planets (the Earth's distance from the Sun being taken as unity), and the movement (in thick, firm lines) of each in its orbit, during a particular month (June 1921). The four inner orbits are drawn to scale; but not so the four outer ones, owing to their great distance from the Sun. If the Earth's distance were assumed

to be 1, that of Jupiter would be represented by the figure 5, Saturn by 10, Uranus by 20, and Neptune by 30. The planets move round the Sun in ellipses, with the Sun in one of the foci, but the ellipticity is not very pronounced except for Mercury and Mars, whose orbits



are thus drawn as circles (which are sufficiently exact for the illustration) with the Sun placed eccentrically in the appropriate position. The zodiacal constellations occupy spaces of 30° along the ecliptic ; the Sun, as viewed from the Earth, passes through each of these in succession from right to left, in the order of the Signs, in the course of the year. In the diagram (much enlarged) of the Earth, the outer half of which is shaded to indicate night, *s* represents sun-set, *r* sun-rise, and *m* mid-night. In the orbits of the planets, including that of the Earth, round the Sun, when a planet is to the left (or east) of the Sun, as seen from the Earth, it is an evening star in the western sky ; when to the right (or west) of the Sun, it is a morning star in the eastern sky. The heliocentric longitudes of the planets, as plotted, are the angular distances measured on the ecliptic, from the vernal equinox, or First Point of Aries, reckoned in the order of the Signs, from 0° to 360°.

From an inspection of the diagram, for the particular month (June 1921), it will be apparent that the Sun will be in the constellation Taurus (or Sign Gemini) at the commencement of the month, and in the constellatiou Gemiui (or Sign Cancer) at its close. Mercury appears to the left of the Sun, at any period of the month, and hence is an eveniug star all through the month; and Venus is, similarly, situated on the right, and so is a morning star during the entire month. The Earth, the Sun and Mars will be seen to be in a straight line about the end of the month, when Mars is said to be in conjunction with the Sun; Mars, therefore, is au evening star prior to that occurrence, and a morning star subsequent to it. Jupiter and Saturn appear in quadrature with the Sun, 90° E., early in the month, while Mercury is at its elongation E. towards the middle of the month. Uranus, it will be noticed, is located in the constellation of Aquarius, and Neptune in that of Cancer ; while Saturn and Jupiter are in Leo ; and Mars, with the movement of the Earth in its orbit, shifts its position from Taurus into Gemini.

By a study of the Planetary Diagram, and a comparison with the proper Star Chart, (*see* Chart VIII), the various movements described are easily followed. The diagram itself refers, of course, to the month of June 1921 only. For other months, the positions of the planets would, naturally, alter; those of the Earth would appear at the points (denoted by the figures 1 to 12 for the several months, January to December) in its orbit manifested in the plan, and would be fairly constant from year to year; but of the other planets, they would continually change, from month to month, during their different orbital periods.

[The magnitudes of the sun and moon, the earth being 1, are 108·5 and 0·2736, respectively. The mean velocity of a Planet in its orbit may be calculated by the formula: $x = v\sqrt{\frac{1}{D}}$ where v represents the mean velocity of the earth in miles per second, and D the distance in terms of the earth's distance from the sun. The maximum brightness, or 'greatest brilliancy,' occurs at the epoch of 39° from the sun, 69 days before (E.) or after (W.) its inferior conjunction.]

The Greek Alphabet.

α	Alpha.	η	Eta.	ν	Nu.	τ	Tau.
β	Beta.	θ	Theta.	ξ	Xi.	υ	Upsilon.
γ	Gamma.	ι	Iota.	ο	Omicron.	φ	Phi.
δ	Delta.	κ	Kappa.	π	Pi.	χ	Chi.
ε	Epsilon.	λ	Lambda.	ρ	Rho.	ψ	Psi.
ζ	Zeta.	μ	Mu.	σ	Sigma.	ω	Omega.

Astronomical Symbols and Abbreviations.

Letter.	Name.	Letter.	Name.	Letter.	Name.
☉	The Sun.	♂	Mars.	☌	Conjunction.
☾	The Moon.	♃	Jupiter.	□	Quadrature.
☿	Mercury.	♄	Saturn.	☍	Opposition.
♀	Venus.	♅	Uranus.	☊	Ascending Node.
⊖ or ♁	The Earth.	♆	Neptune.	☋	Descending Node.

h.	Hours.	°	Degrees.				
m.	Minutes of Time.	′	Minutes of Arc.	N.	North.	S.	South.
s.	Seconds of Time.	″	Seconds of Arc.	E.	East.	W.	West.

Aspects of the Night Sky.

THE NIGHT SKY IN NOVEMBER.

Star Chart No. I.

The central Hour Circle of 0 Hours forms the local meridian.

The *Ecliptic* cuts the Equator, and the meridian, at exactly 20° S. from the zenith. The point of intersection is technically known as the 'First Point of Aries', from which celestial longitude is reckoned, though, in fact, it is now actually in Pisces; this alteration in position, through a long retrogressive process, of over 2,000 years, from the adjoining constellation of Aries, in the E., is due to the precession of the equinoxes. The law of precession is that the celestial pole is in motion and makes a complete revolution round the pole of the ecliptic in about 25,800 years.

The Viâ Lactea (Milky Way) extends across the face of the heavens, in an encircling zone extending from E. to W. It crosses the meridian some 30° from the zenith, facing N., and bifurcates in the N. W. It lies wholly above the equator, and passes alongside of or through Gemini, Taurus, Auriga, Perseus, Cassiopeia, Andromeda, Cygnus, Delphinus, and Aquila.

The winter constellations have put in an appearance in the E., while the constellations of the autumn are going down in the W. The Twins have their feet forward, just above the horizon, almost touching the tips of the two horns of the Bull, represented by the small stars β (Nath) and ζ. The number of stars of the first-magnitude that are visible in the sky is 8.

The North Star (Polaris) is just over 1° S. S. E. of the celestial pole. Its Guardians, β and γ of Ursa Minor (the Little Bear), lie in the opposite direction, nearly 20° away, to N. W. Towards the E. N. E. the sky is almost blank.

The Pole Star (α Ursæ Minoris) may be readily found by means of the Pointers (α and β in Ursa Major), when these two stars of the Plough are visible above the sensible horizon, as they invariably point almost directly to it, without any intervening star. The constellations appear to revolve daily as one great whole around the celestial poles, from east to west, without change in position in respect to each other, while the Pole Star (Polaris) remains practically stationary. If the northern celestial sphere (*see* Charts XIII and XIV) were assumed to be divided into 4 quarters, with the Pole Star as centre, they would, during the year, be directed in rotation to the four points of the compass, moving in the opposite direction to that of the hands of a clock, so that every 6 months their positions in the sky become exactly reversed. If, therefore, the Plough were on one side, as E., of the Pole Star, Cassiopeia, the 'W' would appear on the opposite side, or W., while the two bright stars, Vega (α in Lyra) and Capella (α in Auriga), would also appear opposite to each other in the N. & S., respectively.

The bright stars Capella (the Goat), Mirfak (the Heart of the Rescuer), and Algol (the Demon Star), a well-known variable, are now well risen in the N. E.; the first-named is reddish in colour, and, with a parallax of 0″·080, distant 41 light-years from the Earth. Vertically below Capella is β Aurigæ (of the Charioteer), called Menkaliman, meaning the 'Shoulder of the Rein-holder.'

Deneb (the Tail of the Swan) in the N. W., and Altair (the Soaring Eagle) in the W., are on their way down. Between the former and the horizon, a little to the left and conspicuous in its splendour, is seen Vega (the Swooping Eagle), one of the two brightest stars (Capella being the other) in the northern sky.

The easily distinguished cluster of the Pleiades (of the Bull) is seen E. N. E. from the zenith, in a vertical line with, and about 20° below, the chief star of the Ram.

Pisces is on the meridian, S. ; this is the last (or 12th) of the Constellations, but the first of the Signs, of the Zodiac ; it is barren of prominent stars. The *constellation* of Pisces is now in the *sign* of Aries.

Fomalhaut (the Fish's Mouth) is low down in the S. S. W. Achernar (the End of the River) is a little above the horizon in the S. S. E. ; the River Eridanus is the next longest constellation, after Hydra, in the sky. Light from Fomalhaut, with a parallax of 0″·132, takes 25 years, and from Achernar, with a parallax of 0″·107, 30 years, to reach the Earth. The Great Square of Pegasus (the Flying Horse) is right across the meridian, N. ; its western stars Scheat (the left Foreleg) and Markab (the Saddle) being each about 10° distant from the zenith, W. N. W. and W. S. W. ; these two stars are on the same meridian, which connect the N. and S. Poles, and approximately point to Polaris on the N. and Fomalhaut on the S. Mira (the Wonderful Star of Cetus) is some 30° from the zenith, S. E.

The constellation of Cassiopeia (the Lady in her Chair) is approaching the meridian, looking N. ; and Orion's Belt, as also Betelgeuse and Rigel, in the constellation of Orion (the Hunter), have begun to show up in the E. The star β Cassiopeia (or Caph, which signifies the Hand) is on the meridian, 31° above the N. Pole ; to its right is a beautiful nebula, but which can only be seen with artificial aid.

The small, semi-circular string of stars composing the constellation of Lepus (the Hare) touches the horizon, in the E. S. E. Higher up, above Eridanus, comes the great Cetus (the Sea-Monster), which occupies a large space of the sky with its numerous stars of low magnitude.

The Galactic Belt, or Galaxy, separates Cassiopeia from Andromeda (the Chained Lady) whose leading star Alpherat (the Horse), on the meridian, is very nearly overhead.

The long constellation of Draco (the Dragon), one of the oldest asterisms, is now subsiding in the N. N. W., the head of the reptile being quite evident near the horizon in the N. W. King Cepheus is directly above, who is separated from his beautiful Queen Cassiopeia by the central meridian, and whose graceful daughter Andromeda reposes just above the latter constellation.

The constellations of the zodiac on and to the W. of the meridian do not contain any very bright stars; but in the constellation of the Bull, in the N. N. E., may be seen the brilliant star Aldebaran (the Follower), which marks the Bull's right eye.

On the meridian, low S., one above the other, are to be found the minor constellations of Toucan (the American Goose), Phœnix (the Phœnix), and Sculptor (the Sculptor's Workshop) ; while to the left and right are Fornax (the Chemical Furnace) and Grus (the Crane).

Triangulum (the Northern Triangle) is not far from the zenith, immediately to the right of Andromeda. Delphinus (the Dolphin) is alongside of Cygnus, on the left. The Giant Her-

cules is disappearing in the N. W., his feet only showing above the horizon.

The S. Galactic Pole is situated in Sculptor, in the S.; while the N. Ecliptic Pole is in Draco, in the N. N. W.; the former region is somewhat barren of stellar objects.

The zodiacal constellations extend from the W. S. W. to the E. N. E., and consist of the following, in consecutive order, *viz.*, Capricornus (the Sea-Goat), Aquarius (the Water-Bearer), Pisces (the Fishes), Aries (the Ram), Taurus (the Bull), and Gemini (the Twins).

The principal meteoric showers are (i) the Leonids, 14th-16th; its maximum occurs on the 15th; radiant: Leo (*see* Chart III); characteristic: swift, streaks; and (ii) the Andromedids, 17th-23rd; radiant: Andromeda; characteristic: very slow, trains. The former shower is of a periodic character, with brilliant returns every 33¼ years, and reckoned to be the greatest of all star showers; there were fine displays in 1833 and 1866, but not in 1899; the meteors form the *débris* of Comet I of 1866, and move in nearly the same orbit as the Comet; the radiant point is placed within the well-known group of stars composing the Sickle of Leo. The Leonids were originally considered to form the *débris* of Temple's Comet, and to move in nearly the same orbit as that Comet, but more recent investigations connect the stream with Comet I of 1866, the identity of both orbits being now fairly well established. The shower which radiates from Andromeda travels in the orbit of Biela's Comet. Minor showers are the ε Perseids, 6th, and ε Taurids, 15th-26th.

Meteors are the nearest to us of all the objects that are seen in the sky. The 'radiant point' is that point in the sky whence meteoric showers, or shooting stars in great number, emanate; the position of the radiant gives the direction in which the meteors are moving relative to the Earth. The existence of a radiant point shows that all meteors are moving in parallel lines; if meteors were falling perpendicular to the earth, their paths when drawn on a globe would all pass through the zenith. It has now been definitely established, from careful observation, that there is a distinct connection between comets and meteors; and the orbits of several meteor showers have been identified with those of known comets; *e.g.*, the one of June 1921, first seen in June 1916, having relation to Winnecke's Comet, which, since its discovery a century ago, had increased its period (5·984 years, in 1921) by some 4 months, and its perihelion distance from about three-fourths of the radius of the Earth's orbit to about unity (1·0408, in 1921); perturbations by Jupiter in 1918, produced by the near approach of the Comet at aphelion to the Planet, had altered the cometary path and lengthened the period of revolution, till at the last perihelion (13th June 1921) the Comet was about 2¼ (correctly 2·26) million miles *outside* the true (not mean) terrestrial orbit—as against about 3½ (correctly 3·44) million miles *inside* the true (not mean) terrestrial orbit, at the previous perihelion (1st September 1915)—and owing to this enhanced distance, conditions were changed and the expected meteor shower, other than some stray shooting stars, did not occur; at all events, the spectacular effects that were attributed to the Comet, either by its own brightness or by causing an abnormal display of meteors, were absent on the occasion, and although the search was fruitless, it had considerable negative value as showing that the dense part of the meteor swarm did not intersect the orbit of the earth. The next return of the Comet is due early in June 1927.

THE NIGHT SKY IN DECEMBER.

Star Chart No. II.

The central Hour Circle of 2 Hours forms the local meridian.

The Ecliptic intersects the meridian at some 10° S. of the zenith, and also the Equator about 30° W. S. W. from the zenith.

The Viâ Lactea (Milky Way) traverses the sky, in the form of an arc, and extends from the E. S. E., passing midway between the zenith and North Pole, to the W. N. W. It goes through or between Canis Major and Minor, Orion, Gemini, Taurus, Auriga, Perseus, Cassiopeia, Andromeda, Cygnus, and Delphinus.

The winter solstice occurs in the month, and the beautiful winter constellations (embracing Aries-Taurus-Gemini) are now seen to great advantage, mostly in the eastern sky, which is studded with stellar objects of much beauty. There are 9 first-magnitude stars of the celestial kingdom which appear in the heavens. The days at this period, in the northern hemisphere, are short and the nights long; the Sun then is at its maximum distance *below* the equinoctial, S. (*see* Chart XIV), when, too, its farthest *South* Reach on the meridian, at its lowest altitude S. (of 46° 33′, in latitude 20° N.), is attained.

Polaris (the North Star) is almost on the meridian, just above the North Pole. When on the meridian exactly, in its position *above* the Pole, its altitude would correspond to the terrestrial latitude *plus* the polar distance; thus, for Lat. 20° N., $\text{Alt.} = 20^\circ + 1^\circ\,7' = 21^\circ\,7'$. Its constellation of Ursa Minor (the Little Bear) is suspended below it, with Ursa Major (the Great Bear), on its right, coming over the horizon in the N. N. E., and Draco (the Dragon), on its left, disappearing in the N. N. W.

Orion's Belt, belonging to the constellation of Orion (the Hunter), with Betelgeuse and Rigel (the Shoulder and the Foot of the Giant), are now well risen in the E.; the former star is an irregular variable, and the latter a double of a yellowish colour. The three closely associated stars composing the Giant's Girdle steadily follow in the course of the Equator, on the S. side. The tiny, but attractive, constellation of Lepus (the Hare) is seen to the right of Rigel (~~the Foot of the Giant~~); a little lower is Columba (Noah's Dove).

The superb star Sirius (Chief, or the Dog Star), the most conspicuous stellar object in the heavens, Procyon (Before the Dog), and the Twins Castor and Pollux (the Sons of Zeus and Leda) have just begun to show up in the E. S. E., E., and E. N. E., respectively. The constellation of Gemini, to which the Twins belong, is seen in a horizotal position, between Ursa Major on the left and Canis Minor on the right.

Aldebaran (the Follower), Capella (the Goat), Mirfak (the Heart of the Rescuer) and Algol (the Demon Star), a well-known characteristic short-period variable, are high up, to the E. of the meridian. In the neighbourhood of the variables, the Milky Way is rich in the light given out by myriads of tiny stars.

The interesting and pretty cluster of the Pleiades, of the Bull, is now seen to advantage some 20° E. N. E. of the zenith; six of the group are readily discerned with the naked eye. And the star α Arietis (called Hamal), of the constellation of the Ram, is almost exactly on the me-

ridian, N., and very near to the point overhead. Aries is the first of the Constellations, but the second of the Signs, of the Zodiac. The *constellation* of Aries is now in the *sign* of Taurus.

Mira Ceti (the Wonderful Star of Cetus, the Whale), a long-period variable, of close upon a year, is adjacent to the meridian, on the E., and the Equator, on the S.; at its maximum it is of the 2nd magnitude, and then decreases in lustre till it reaches its minimum of the 9th magnitude.

Achernar (the End of the River) and Fomalhaut (the Fish's Mouth) are low down in the S. and S. W.; the former is at the termination of the River Eridanus which comes coursing along, zig-zag fashion, from near Rigel, and crosses the meridian to the S., till it nearly reaches the horizon. On the right of the River are seen the several small constellations of Fornax (the Furnace), Sculptor (the Sculptor), Phœnix (the Phœnix), and Grus (the Crane).

Alpherat (the Horse), which represents the head of Andromeda, and Scheat (of the Flying Horse) lie vertically, one above the other, about half-way between the zenith and horizon, W. N. W.; they form the right side, as now seen, of the Great Square of Pegasus. Formerly the star Alpherat was called both δ Pegasi and α Andromedæ, but now it is known by the latter name alone. Deneb (the Tail of the Swan) will soon be disappearing in the N. W.; the Cross of Cygnus stands nearly upright, slanting to the right.

The constellation of Cassiopeia (the Lady in her Chair) has just crossed the meridian, looking N.; its five principal stars are quite prominent, in the shape of the letter W; it is usually known as the Lesser W, for there is also a Greater W, composed of the stars α and β Persei, γ Andromedæ, β Trianguli and β Andromedæ.

Andromeda (the Chained Lady) reclines downward, with her head at α and her feet on the meridian at γ; she is vertically above Cassiopeia, with Pegasus on the left and Perseus on the right. Delphinus (the Dolphin) is about to disappear in the W. N. W.

The S. Galactic Pole has gone past the meridian, on its W., and the N. Ecliptic Pole is nearly touching the horizon, N. N. W.

The zodiacal constellations extend from the W. S. W. to the E. N. E., and comprise the following, in consecutive order, *viz.*, Capricornus (the Sea-Goat), Aquarius (the Water-Bearer), Pisces (theFishes), Aries (the Ram), Taurus (the Bull), Gemini (the Twins),and Cancer (the Crab).

The principal meteoric showers are the Geminids, 2nd-15th; radiant: Gemini; characteristic: swift, short; trained meteors. Minor showers are the β Geminids, 2nd-15th, α Ursæ Majorids, 19th-22nd; and κ Draconids, 19th-29th.

THE NIGHT SKY IN JANUARY.

Star Chart No. III.

The central Hour Circle of 4 Hours forms the local meridian.

The Ecliptic crosses the Equator some 60° from the zenith, W. b. S., in the constellation of Pisces; and it intersects the meridian almost exactly overhead.

The Via Lactea (Milky Way) stretches across the sky, in the form of a bow, from the S. E. to the N. W., passing about 20° N. E. from the zenith. It goes through Argo and Mono-

ceros, between Canis Major and Minor, and Orion-Gemini, and through Taurus, Auriga, Perseus, Cassiopeia, Andromeda, Cepheus, and Cygnus.

The winter constellations are now well advanced, and are resplendent high up in the sky. There are so many as 10, out of a total of 20, first-magnitude stars shining out simultaneously in the heavens.

The Pole Star (Polaris) is seen at a little over 1° to the S. W. of the celestial pole, Ursa Minor (the Little Bear) being still below it. Cepheus (King) lies horizontally to the left and the tip of the tail of Draco (the Dragon) is in evidence between the two Bears.

Ursa Major (the Great Bear) is now showing up in the N. E., all but the tail which is still below the horizon.

The bright stars Capella (the Goat) and Aldebaran (the Follower) are approaching the meridian; both shine out brilliantly at their present high elevation. In fact, the clear, wintry sky of the period abounds with the foremost refulgent stars, most of which are in the neighbourhood of the Galaxy. Capella and Rigel are nearly in the same meridian, and point approximately to the N. and S. Poles.

Taurus, which is directly overhead, forms the second Constellation, but the third Sign, of the Zodiac. The *constellation* of Taurus is now in the *sign* of Gemini.

Sirius (the Chief, or Dog Star), the brightest star in the heavens, is ablaze in the S. E.; while Procyon (Before the Dog) shines out well in the E. The former is travelling through space at the enormous velocity of 20 miles per second, and is twice as much more distant from the Earth than the nearest star (*a* Centauri); it is one of our closest neighbours, with a parallax of 0″·37, and light from it takes about 8½ years to reach the Earth; in colour, it is intensely white, with a tinge of blue. The latter is yellowish-white in colour, having a parallax of 0″·325, and is 10 light-years distant from the Earth; *i.e.*, about 44 billion miles.

The Twins, Castor and Pollux (the Sons of Zeus and Leda), are showing up in the E.N.E.; the latter is 43 light-years away from us. Immediately below them, in Cancer, is to be found a very interesting cluster called Præsepe (not shown on the Map), or the 'Beehive'; this formed the weather-glass of the ancients, who took it as an indication of fair weather when the conglomeration could be visually disintegrated into its components of stars, one (Zeta) of which is a remarkable triple star; on either side of the cluster are two small stars (also not on the Map) which were known to the ancients as Aselli.

Canopus (the Pilot of Menelaus), the next in order of brightness after Sirius, is low down in the S. S. E.; it is also designated the 'Star of the Nile.' The distance separating this star, as also Rigel, from us must be vast, and could not be under 300 light-years or 100 parsecs; for, so far, their parallaxes have been incapable of determination.

Orion (the Hunter), with his Belt of three evenly placed stars and the brilliants Betelguese (the Shoulder) and Rigel (the Foot), resting respectively on his left arm and left foot, approaches the meridian; it forms the most beautiful and lustrous of the constellations of the celestial sphere. The most northerly star, δ Orionis, of the Belt, lies almost exactly on the Equator; and as such is equidistant from the poles, and also rises and sets due E. and W.

The little star-group of Lepus (the Hare) is situated on the S., between Canis Major and

Eridanus; it has the almost insignificant, but withal noticeable, Columba (Noah's Dove) vertically below. The other small southern constellations consist of Dorado (the Sword Fish), close to the meridian, on the E.; and of Fornax (the Chemical Furnace), Sculptor (the Sculptor's Workshop), and Phœnix (the Phœnix), also not far from the meridian, in the W.

The compact cluster of stars denominated the Pleiades, of the Bull, is now almost exactly overhead. Another group (not apparent on the Map) may be noticed, near Aldebaran, called the Hyades (the 7 stars in the head, round about the mouth, of Taurus); but this is not so conspicuous as the Pleiades. COR LEONIS

Regulus (the Little King) is just rising in the E., and Deneb (the Tail of the Swan) setting in the N. W. The constellation of Leo is the forerunner of the spring season.

Al Fard (the Solitary One) is in the E. b. S., and Achernar (the End of the River) in the S. S. W., both close to the horizon.

The inconspicuous, but pretty, constellations of Lepus (the Hare) and Columba (Noah's Dove) have gone past the meridian, on the W; they are to be seen not far from Sirius.

The variables Algol (the Demon Star) and Mira (the Wonderful Star of Cetus) have passed to the W. of the meridian. These stars have periods of *2d. 21h.* (in reality, *20h. 48m. 55s.*) and *331d. 8h.*, respectively; the former varies in brightness from the 2nd to the 4th magnitude, and the latter from the 2nd to the 9th magnitude. Algol takes 4½ hours in its transition from maximum to minimum, at which it remains for 20 minutes, and then takes 3½ hours to regain its maximum; the whole eclipse by the smaller dark companion planet which revolves round the star, occupies about 9 hours; the position (1921) of the principal is R. A. *3h. 3m.*, Dec. 40° 39′ N. Mira is very faint for about 5 months of its period; it then gradually increases in brightness till it reaches its maximum, when it again gradually sinks to its minimum; its position (1921) is R. A. *2h. 13m.*, Dec. 3° 14′ S.

The constellation of Cassiopeia (the Lady in her Chair) faces N. N. W., midway between the zenith and the horizon; and that of Malus (the Mast of the Ship Argo) has just made its appearance in the S. E.

Andromeda (the Chained Lady) rests between Cassiopeia, on the right, and Pegasus (the Flying Horse), on the left; she is midway between the zenith and horizon, in the N.W. Vertically above her is the small constellation of Triangulum Borealis (the Northern Triangle), and still higher is Aries, which is recognizable by the 3 stars—α, β and γ (the last of which two are unnamed on the Map, but are seen to adjoin α, on its left)—forming the Ram's head.

The S. Galactic Pole is close to the horizon in the S. W., and the N. Ecliptic Pole is making its exit in the N. b. W.

The zodiacal constellations extend from the W. S. W. to the E. N. E., and comprise the following, in consecutive order, *viz.*, Aquarius (the Water-Bearer), Pisces (the Fishes), Aries (the Ram), Taurus (the Bull), Gemini (the Twins), Cancer (the Crab), and Leo (the Lion).

The principal meteoric showers are the Quadrantids, 3rd-5th; radiant: Draco-Hercules (*see* Chart VI); characteristic: swift, long paths; maximum in 1863-66. Minor showers are ζ Cepheids, 25th.

THE NIGHT SKY IN FEBRUARY.

Star Chart No. IV.

The central Hour Circle of 6 Hours forms the local meridian.

The Ecliptic meets the Equator due W. and E., in the constellations of Pisces and Virgo ; and it cuts the meridian some 3° above the zenith.

The Viâ Lactea (Milky Way) extends across the face of the sky, in the form of a great arch, passing overhead from the S. E. to the N. W. It emanates from Argo and terminates in Cepheus, proceeding by Monoceros, between Canis Major and Minor, and Orion and Gemini, and through Taurus, Auriga, Perseus, Cassiopeia, and Andromeda.

The spring constellations have begun to appear in the E., and the winter constellations are making their exit in the W. Of first-magnitude stars, 9 are scintillating well in the heavens.

The 'Pointers' in Ursa Major (the Great Bear) are showing up in the N. E. ; they are uppermost and point to Polaris (the Pole Star), which is just over 1° to the W. of the N. Pole. At other periods, too, when the Great Bear is below the horizon, the Polar Star can always be located as it is practically N. and of about the same altitude, *i.e.*, above the horizon, as the latitude of the place. The Guardians of the Pole are seen below, and to the right, of the Pole ; they are close to Draco (the Dragon). To the immediate left of the Little Bear is King Cepheus in an inverted position, with his left foot resting near the Pole and the upper half of his body underneath the horizon.

The Dog Star, Sirius (Chief), the most luminous star in the heavens, is approaching the meridian, and the bright star Capella (the Goat) just leaving it, on the S. and N. sides ; they would be about 37° and 26° distant from the zenith, on the meridian, for a position of latitude 20° N.

Canopus (the Pilot of Menelaus), the second brightest star in the firmament, is low down almost due S. ; it shines out most brilliantly owing to the density of the atmosphere surrounding it, because of its low elevation. This conspicuous star is situated in the stern (Puppis Argûs) of the Ship Argo nearly the whole of which has come into view, inclusive of the major portion of the False Cross in the S. S. E. Its altitude, when on the meridian, in latitude 20° N., is about 17°. The complete ship forms one of the largest constellations in the sky.

Procyon (Before the Dog), and Castor and Pollux (the Twin Sons of Zeus and Leda) are well risen in the E. S. E. and E. N. E. ; each is but some 20° distant from the zenith.

Aldebaran (the Follower), and Betelgeuse and Rigel (the Shoulder and Foot, respectively, of the Giant) are all high up in the heavens to the W. of the meridian ; the two last form the apexes of the isosceles triangles which project on either side of the base, of Orion's Belt, now at its greatest elevation, of some 70° S. In his present position, Orion (the Hunter) stands quite erect, with his head in the direction of the zenith ; his Girdle of three stars is placed horizontally. The three stars Procyon, Betelgeuse and Sirius together form a large and prominent equilateral triangle, now at a high elevation in the southern sky ; while the two last with Aldebaran and Rigel present the figure of an elongated diamond.

Gemini is on the meridian, N. ; it forms the 3rd of the Zodiacal Constellations, but 4th of the Signs. The *constellation* of Gemini is now in the *sign* of Cancer.

The interesting cluster of the Pleiades has gone past the meridian on the W., about 20° from the zenith.

Regulus (the Little King) and Denebola (the Lion's Tail) are risen in the E., and Alpherat (the Horse) is sinking in the W. N. W.

Al Fard (the Solitary One) is in the E. S. E., half-way between Procyon and the horizon; it belongs to Hydra (the Water-Snake), the longest constellation in the heavens. On the right are Monoceros (the Unicorn) and Malus (the Mast of the Ship Argo); and on the left are Sextans (the Sextant) and Crater (the Cup).

The long and straggling River Eridanus, one of the old asterisms, has its source near Rigel, and disappears below the horizon, in the S. W. Low down, on either side of it, to the left and right, are Doradus (the Sword Fish) and Fornax (the Furnace).

Algol (the Demon Star) and Mira (the Wonderful Star of Cetus), the well-known short and long-term variables, are mid-way between the zenith and horizon in the N. W. and W. S. W.

The two Ladies, Cassiopeia (the Lady in her Chair) and Andromeda (the Chained Lady), are about to make their exit in the N. W.; the former is easily recognized by her 5 brightest stars resembling the letter W. Close to the left of the latter is Triangulum (the Northern Triangle).

The N. Galactic Pole and the S. Ecliptic Pole, have come into being, in the E. N. E. and the S., fringing the horizon; the former is in Coma Berinices, and the latter in Doradus.

The zodiacal constellations extend from due W. to due E., and comprise the following, in consecutive order, *viz.*, Pisces (the Fishes), Aries (the Ram), Taurus (the Bull), Gemini (the Twins), Cancer (the Crab), Leo (the Lion), and Virgo (the Virgin).

There are no meteoric showers of importance in the month. Minor showers are the *a* Leonids, 20th February-2nd March.

THE NIGHT SKY IN MARCH.

Star Chart No. V.

The central Hour Circle of 8 Hours forms the local meridian.

The Ecliptic cuts the Equator some 30° above the eastern horizon, and crosses the meridian at exactly overhead.

The Viâ Lactea (Milky Way) extends across the face of the heavens, in the form of a bow, from the S. S. E. to the N. N. W.; passing about 30° from the zenith in the direction of W. S. W.; it goes through Argo and Monoceros, between Canis Major and Minor, and Orion and Gemini, and again through Taurus, Auriga, Perseus, Cassiopeia, and Andromeda.

The vernal equinox occurs in the month, and the spring constellations (embracing Cancer-Leo-Virgo) are in evidence in the eastern section of the sky. There are no less than 11, or slightly over one-half of the total number, first magnitude stars resplendent in the heavens. The stars of the spring evening sky form the most brilliant grouping of the sphere. The Sun

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at this stage crosses the equinoctial from S. to N. (*see* Chart XIII), when there is equal day and night at all places; the Sun appears to rise due E. and set due W. (*see* Charts XIV and XIII); in practice, though, refraction (2 m.) and semi-diameter (1 m.) combine to make the day some 12 m. longer than the night.

The Pole Star (Polaris) is almost due W., of a little over 1° distant from the celestial pole; *its maximum elongation W., in the middle of the month, occurs at about 8-0 p.m. (local* time). Its constellation of Ursa Minor (the Little Bear) is now almost horizontal, with the Guardians facing Draco (the Dragon). To the left of the Little Bear appears the lower section of King Cepheus.

Ursa Major (the Great Bear) is well placed for observation between the horizon and zenith, in the N. E.; the 'Pointers' show the direction of the North Pole.

The Twins, Castor and Pollux (the Sons of Zeus and Leda), are nearly overhead; they are in a direct vertical line, with Pollux uppermost. Procyon (Before the Dog), of the constellation of Canis Minor (the Little Dog), has just passed the meridian, towards the S.; its meridional distance is about 15° from the zenith, and, consequently, about 5° from the Equator (or Equinoctial). Pollux and Betelgeuse are equidistant from Procyon, and form with it a well-shaped right-angled triangle, with the right angle at the middle, or last-named, star.

Regulus (the Little King) is well up in the E., and Canopus (the Pilot of Menelaus) low down in the S. S. W.; the whole of the Ship Argo, the stem of which is indicated by the latter star, is now visible. The False Cross of Carina (the Keel of Argo Navis), of which the star ϵ is at the bottom, is noticeable close on to the meridian, in the extreme S.; it consists of three stars of the second-magnitude and one of the third, and circles round the South Pole (not on the Map; but *see* Chart XIII), the altitude of ϵ, when on the meridian, is 11°, in a latitude of 20° N.

Arcturus (the Watcher of the Bear) and Spica (the Ear of Corn) have just risen in the E. N. E. and the E. b. S. These brilliants belong to the constellations of Boötes (the Herdsman) and Virgo (the Virgin). In the former constellation may be noticed the star ϵ, almost touching *the horizon; this is a beautiful binary.*

Al Fard (the Solitary One), also called Cor Hydræ (the Heart of Hydra), shines out in the S. E., nearly 40° from the zenith; the head of Hydra (the Water-Snake), which contains a triple star (ϵ), is not far from Procyon, and the tail goes past Crater (the Cup) and also Corvus (the Crow), both old constellations, to the right of Spica; below Procyon is the small constellation of Monoceros (the Unicorn), on the right, and of Sextans (the Sextant) on the left. In tiss part of the sky there is an absence of conspicuous stars.

Cancer is exactly overhead; it forms the 4th of the Zodiacal Constellations, but 5th of the Signs. The *constellation* of Cancer is now in the *sign* of Leo.

Capella (the Goat), the ruddy Aldebaran (the Follower), Betelgeuse and Rigel (the Shoulder and the Foot of the Giant) are prominent objects westward; the last two are situated on either side of and exactly betweeen Orion's Belt, which is composed of 3 second-magnitude stars known as the 'Three Kings.' Directly below the middle star of the Belt lies the great Nebula of Orion, which even a small telescope will show to advantage, in a display of minute stars shining through a luminous cloud; but it requires one of the great modern telescopes to truly

reveal the glories of the Creator, in a manifestation of the endless suns that compose the Nebula.

Algol (the Demon Star) is on its way out, in the N. W.; and Mira (the Wonderful Star of Cetus) is about to disappear in the exact W.

The comet-like Pleiades, of the Bull, is approaching the horizon in the W. N. W. In close proximity, underneath, is noticed the Ram, with the Northern Triangle (Triangulum Borealis) on its immediate right; both these constellations are now sinking in the W. N.-W.

The constellation of Cassiopeia (the Lady in her Chair) will soon make its exit in the N. N. W.; while Andromeda (the Chained Lady) is already, in part, below the horizon, in the N. W.

The Dog Star, Sirius (the Chief), the brilliant star of Canis Major (the Great Dog), is lustrous in the heavens, in the S. S. W., between the meridian and the small constellation of Lepus (the Hare); below which again is observed Colnmba (Noah's Dove). The River Eridanus is to the right of these; it consists chiefly of small stars, and covers a wide expanse of sky. The star β Canis Minoris, to the right and above Procyon, is named Gomeisa (the Dim-eyed); and the star β Canis Majoris, to the right and below Sirius, is named Murzim (the Announcer). Sirius itself is now well placed for observation.

The N. Galactic Pole is about 30° from the horizon, E. N. E.; and the N. Ecliptic Pole is almost touching the horizon, N. N. E.

The zodiacal constellations extend from the W. b. N. to the E. b. S., and comprise the following, in consecutive order, *viz.*, Aries (the Ram), Taurus (the Bull), Gemini (the Twins), Cancer (the Crab), Leo (the Lion), and Virgo (the Virgin).

There are no meteoric showers of importance in the month. Minor showers are the τ Leonids, 2nd-5th; and β Ursids, 13th-24th.

THE NIGHT SKY IN APRIL.

Star Chart No. VI.

The central Hour Circle of 10 Hours forms the local meridian.

The Ecliptic cuts the Equator some 30° S. E. from the zenith, and also the meridian at about 10° S. from the same point.

The Viâ Lactea (Milky Way) traverses the sky, but somewhat low down, in the form of a well-bent curve emanating from the S. S. E., and disappearing in the N. N. W. It begins in Crux and ends in Cassiopeia, and *en route* crosses Centaurus and Argo, passes between Canis Major and Minor, and Orion and Gemini, and goes through Taurus, Auriga, and Perseus. The Galaxy is brightest in the region enclosed by the Ecliptic and Equator which contains the densest formations of minute stars.

The spring constellations are now high up in the heavens. There are as many as 10 first-magnitude stars which are shining out brilliantly in the sky.

The Pole Star (Polaris) is not much over 1° to the N. W. of the Pole; its constellation of Ursa Minor (the Little Bear) twists slightly upwards, on the right. In shape, but inverted, the smaller Bear resembles its bigger name-sake; the difference between them, however, is that

while the 7 principal stars of the former are circumpolar, for the latitude of 20° N., those of the latter sink beneath the horizon, in their apparent course from W. to E. (*i.e.*, from left to right) below the celestial pole. On the immediate left appear the lower limbs of Cepheus (King) and Cassiopeia (the Lady in her Chair), the remainder of their bodies being below the horizon.

Ursa Major (the Great Bear) is some 30° above the Pole, close on to the meridian. The two bright stars, α and β, forming the left side of the quadrilateral, are called the 'Pointers,' because they always, in whatever portion of the sky, point to the North Star.

Draco (the Dragon) forms a loop of stars between the two Bears ; its head is just above the horizon in the N. E., and its tail near Dubhe (the Bear) ; it is one of the oldest and best known of the constellations.

Alphecca (the Broken Platter), of the Northern Crown, lies between Boötes (the Herdsman) and Hercules (the Kneeling Man), in the N. N. E.

Regulus (the Little King, or the Lion's Heart) is almost overhead, just above the Ecliptic and close to the meridian ; it belongs to the constellation of Leo (the Lion), and forms the handle, now vertical, of the Sickle ; it is reckoned to be 1,000 times brighter than the Sun, and light from it takes so much as 153 years to come to us. Regulus shines out brilliantly in the sky, and may be conceived to hang round the Lion's neck, by an imaginary ribbon, in the manner of the Star of India. There are also two second-magnitude stars in the constellation, *viz.*, β and γ Leonis, marking the extremity of the tail and the head of the Lion ; the latter is a fine double, and the zenith star (Dec. = 20° 14′ N.) of the position (Lat. = 20° N.) for which the Star Maps have been constructed. To the S. S. W. of the zenith, some 30°, is Al Fard, or Cor Hydræ (the Heart of the Snake) ; and near by the tail of the reptile, on the under side, is seen Corvus (the Crow). To the left of Hydra, and somewhat high up, are the small constellations of Sextans (the Sextant) and Crater (the Cup) ; to the right, and also high up, is Monoceros (the Unicorn). The hinder portion of Centaurus (the Centaur) is showing up in the S. E.

The Twins, Castor and Pollux (the Sons of Zeus and Leda), and the bright star Procyon (Before the Dog) are high up W. of the meridian.

Denebola (the Lion's Tail), Spica (the Ear of Corn), and Arcturus (the Watcher of the Bear) are showing up well eastward, and form a fairly symmetrical equilateral triangle. The second of these stars may be likened to an engagement ring worn on the delicate finger of the lovely Virgin, blazing out in light. Almost vertically overhead is noticed the star γ Leonis, close to which is the radiant point whence the famous November Leonids emanate.

The Dog Star, Sirius (Chief), in the S. W., Capella (the Goat), in the N. W., and Orion's Belt, in the W., are about to quit the sky ; while the Pleiades and the variable Algol (the Demon Star) are sinking in the N. W.

Betelgeuse (the Shoulder of the Giant) and Bellatrix (the Woman Warrior) are some 10° apart, the former vertically above the latter, not far distant from the horizon, W.; the former's distance from the Earth is reckoned at 142 light-years, and it is reddish in colour. Rigel (the Foot of the Giant) is at the S. end of the constellation of Orion (the Hunter), a little below the Equator and close to the western horizon. By a new, or interferometer, method, which is yet in the experimental stage, and which consists of a system of mirrors mounted at the top end

of a telescope that reflects the object in two positions thus forming a base for measurement, the angular diameter of Betelgeuse is found to be 0″·045; so that with the distance from the Earth in light-years known, the linear diameter of the star is easily computed and comes to 273 million miles, or about 300 times the diameter of the Sun.

The red star Aldebaran (the Follower) is subsiding in the W. N. W., and shines out brilliantly from its proximity to the horizon; light from it, with its parallax of 0″·107, occupies 30 years to reach the Earth; it lies near the path of the planets, and is sometimes mistaken by amateurs for the ruddy planet Mars. The differences in colour of stars are due to the differences in substances of which these bodies are composed, and also to their temperatures; the red stars are supposed to be less hot than the blue ones. In fact, the theory of stellar evolution has been that stars begin their existence as nebulæ, composed of hot, glowing gas, and passed by cooling through stages of blue, yellow and red stars, severally typified by Sirius, Arcturus and Betelgeuse, to white; this view of the origin of the solar system is described as the 'nebular hypothesis'. In this connection, a novel theory has been advanced of giant and dwarf stars (whose ratio of luminosity is as 10,000 to 1), whereby the magnitude of a star is held to be determined by its real distance from observation instead of its apparent luminosity—*i.e.*, the amount of light emitted as compared with our sun; but the practical result is bound to prove disappointing. Sirius is now bright because it is near; were it as far away from us as some of its apparent neighbours, it would not be visible to the naked eye.

Leo is on the meridian, S.; it forms the 5th of the Zodiacal Constellations, but 6th of the Signs. The *constellation* of Leo is now in the *sign* of Virgo.

The great Ship Argo Navis is spread right across the meridian, S., with its different parts of the Mast (Malus,) Sails (Vela), Keel (Carina), and Poop (Puppis), duly apportioned.

On the extreme south, the False Cross of Carina Argûs (the Keel of the Ship Argo), has gone past the meridian, on the W., by about 10°; and the upper section of the True Cross, of Crux (the Southern Cross), has just begun to appear above the horizon in the S. S. E.; the latter resembles a Maltese Cross and is upright but stunted, while the former is elongated and well proportioned and inclines eastwards. The False Cross (*see* also Chart XIII) is composed of the stars κ, ϵ, ι and δ Argûs, and the True Cross (*see* also Chart XIV) of the stars γ, α, β and δ.

Between the S. W. and W., skirting the horizon, are apparent Columba (Noah's Dove) and Lepus (the Hare), both of which will shortly be hid from view. To their left is visible the last of the River Eridanus, a minor section only of which still lingers above the horizon. Above Sirius is the constellation of Monoceros (the Unicorn).

The N. Galactic Pole is in the E. N. E., about 30° from the zenith; and the N. Ecliptic Pole lies in the N. N. E., about 30° from the N. Pole.

The zodiacal constellations extend from the W. N. W. to the E. S. E., and comprise the following, in consecutive order, *viz.*, Taurus (the Bull), Gemini (the Twins), Cancer (the Crab), Leo (the Lion), Virgo (the Virgin), and Libra (the Balance).

The principal meteoric showers are the Lyrids, 21st–23rd; radiant: Lyra (*see* Chart VII); characteristic: rapid; meteors yellow and white, slightly trained; same orbit as for the great Comet I of 1861. There are no minor showers in the month.

THE NIGHT SKY IN MAY.

STAR CHART No. VII.

The central Hour Circle of 12 Hours forms the local meridian.

The Ecliptic cuts the Equator on the meridian at 20° S. of the zenith.

The Viâ Lactea (Milky Way) is seen a little above the horizon, which it expansively skirts, from the E., along the S. E., S., S. W., and W., to the N. W.; it fringes Ophiuchus, Serpens, Scorpio, and Lupus, goes through Crux, Centaurus and Argo, and a portion of Canis Major, and finally borders on Monoceros, Canis Minor, Gemini and Auriga; and owing to its low altitude throughout is not much in evidence.

The summer constellations have commenced to show up in the E., while the spring constellations are descending in the W. There are so many as 12 first-magnitude stars that can now be seen in the heavens.

The Pole Star (Polaris) is a little over 1° N. N. W. of the celestial pole; it rests upon the extremity of the tail, while the two Guardians form the right leg, of Ursa Minor (the Little Bear). Below comes King Cepheus, with his feet uppermost and his head below the horizon.

Ursa Major (the Great Bear), commonly known as 'The Plough,' is on the meridian some 30° above the N. Pole, with the 'Pointers' on the W.; it is seen due N., and at the highest part of its diurnal course. For a position of Lat. 20° N., Long. 90° E., the upper transit of ϵ Ursæ Majoris (Alioth), at the root of the tail of the Great Bear, for finding the approximate meridian when Alioth and Polaris are in the same vertical plane on opposite sides of the celestial pole, takes place in the middle of the month at about 10 p.m., with altitude (from N.) of about 54°; the corresponding altitude (from N.) of the circumpolar star α Ursæ Minoris (Polaris), at this juncture, *i.e.*, at its lower culmination, would be about 19°. It will be noticed that the positions occupied by Alioth and Polaris on the Map, for the hour for which constructed, at about 8-30 p.m. (local time) on the 15th of the month, are a little to the E. and W., respectively, of the meridian.

Draco (the Dragon) curves round the Lesser Bear, with its prominent head some 20° above the horizon, in the N. E., and its tail across the meridian, a little below the Greater Bear.

Alphecca (of the Northern Crown) is midway between the zenith and horizon, N. N. E.; it is of the 2nd magnitude, and is the principal member of the beautiful chaplet of stars denominated Corona Borealis, of which it alone is shown on the Map. Underneath is Hercules (the Kneeling Man), in which there are no stars of a higher magnitude than the 4th.

In the exact E., Ophiuchus (the Serpent-Bearer) has begun to show up, his head and body being above the horizon; he is astride Serpens (the Serpent) whose head almost reaches to Corona. The former constitutes the only instance in which the Sun passes through other than a zodiacal constellation; this occurs for a period of some 3 weeks in November-December.

Vega (the Swooping Eagle) and Antares (the Rival of Mars) belonging to the constellations of Lyra and Scorpio, have just risen in the N. E. and S. E. The constellation of Scorpio which does not appear in the Map for April—*see* Chart VI) ushers in the summer months.

Capella (the Goat) and Sirius (Chief), or the 'Dog Star,' the brightest star in the whole of the heavens, are about setting in the N. W. and W. S. W.; and being close to the horizon they would both be conspicuous by their great lustre; they appertain to the constellations of Auriga (the Charioteer) and Canis Minor (the Little Dog).

Virgo is on the meridian, S.; it forms the 6th of the Zodiacal Constellations, but 7th of the Signs. The *constellation* of Virgo is now in the *sign* of Libra.

Arcturus (the Watcher of the Bear) and Spica (the Ear of Corn) eastward, and Regulus (the Little King) westward, are well up in the sky; while the bright star Procyon (Before the Dog) is low down in the W.

The constellation of Leo extends from overhead to half-way down towards the horizon, W.; its second most important star, Denebola (the Lion's Tail), is close to the zenith. Above Regulus, and close to the star γ Leonis, is situated the Radiant Point of the famous November meteors, the Leonids.

Castor and Pollux (the Sons of Zeus and Leda), of the constellation of Gemini, are going down in the W. N. W.; they represent the heads of the Twins; the former is a celebrated double star.

Hydra (the Water-Snake) twists and turns from near Cancer to a short distance from Libra; its chief star Al Fard (the Solitary One) being about midway between the zenith and horizon, S. W. On either side of the head of the Snake are the minor constellations, to the left and right, of Sextans (the Sextant) and Monoceros (the Unicorn).

The beautiful constellation of Crux (the Southern Cross) is nearing the meridian, low in the extreme S.; it now stands erect, and when on the meridian attains the greatest elevation which it can reach in the latitude of 20° N. It has two first-magnitude stars, some 20° on the left and right, belonging to the constellations of Centaurus (Centaur) and Vela (the Sails of the Ship Argo), and one each of the second and third magnitudes. The star α Crucis is a triple star; light from it takes 65 years to reach the Earth; it circles round the S. Pole. β Crucis must be ever so much further away, since its parallax is unascertainable, thus far. The Cross on reaching the meridian is quite a striking object in the sky, due in great measure to the atmospheric conditions prevailing at so low an altitude. In a position of Lat. 20° N., Long. 90° E., the principal member (α Crucis) of the Constellation culminates in the middle of the month at about 9 p.m., with an altitude (from S.) of about 7°; it rises near 5 p.m., and sets close upon midnight; its period above the horizon would thus extend to some 7h. It will be seen that the place occupied by α Crucis on the Map, for the hour for which prepared, of about 8-30 p.m. (local time) on the 15th of the month, is slightly to the E. of the meridian. Just below Centaurus, bordering on the horizon, is Lupus (the Wolf).

The N. Galactic Pole is almost overhead, and the N. Ecliptic Pole is a little over 20° to the right of the celestial Pole.

The zodiacal constellations extend from the W. N. W. to the E. S. E., and comprise the following, in consecutive order, *viz.*, Gemini (the Twins), Cancer (the Crab), Leo (the Lion), Virgo (the Virgin), Libra (the Balance), and Scorpio (the Scorpion).

The principal meteoric showers are the γ Aquarids, 2nd-7th; radiant: Aquarius (*see*

Chart IX); characteristic: swift, streaks; orbit same as Halley's Comet (period = 74·42 years; perihelion distance = 0·5922, or 55 million miles from Sun, on 20th April 1910). Less important showers are the ζ Herculids, 19th-27th; and η Pegasids, 31st May-5th June (*see* Chart IX).

THE NIGHT SKY IN JUNE.

Star Chart No. VIII.

The central Hour Circle of 14 Hours forms the local meridian.

The Ecliptic cuts the Equator some 30° from the zenith, in the S. W.

The Viâ Lactea (Milky Way) extends, in the form of a salient curve, low down and skirting the horizon, from the N. E., by the E. and S. E., to the S; it commences in Cepheus, passes through Cygnus, Aquila, Ophiuchus, Serpens, Sagittarius, Scorpio, Ara, Lupus, Triangulum Australis and Centaurus, and terminates in Crux.

The summer solstice occurs this month, and the summer constellations (embracing Libra-Scorpio-Sagittarius) are now in full view in the eastern sky. Of first-magnitude stars, there are no fewer than 11 visible. At this period, in the northern hemisphere, the days are long and the nights short; the Sun then is at its maximum distance *above* the equinoctial, N. (*see* Chart XIII), when, too, its farthest *North* Reach on the meridian, at its lowest altitude N. (of 86°33′, in latitude 20° N.) is attained.

Polaris (the North Star) is nearly on the meridian, a little below the N. Pole. When on the meridian exactly, in its position *below* the Pole, its altitude would correspond to the terrestrial latitude *minus* the polar distance; thus, for Lat. 20° N., Alt. = 20° − 1° 7′ = 18° 53″. It is conspicuous at all hours of the night, and forms a reliable guide for both at sea and on land in the northern hemisphere. The star is circumpolar, with a small radius; it is a binary, and light from it takes 65 years to come to us. Its exact distance from the celestial pole, at the present time, is 1° 7′; and, in its precessional motion, it will reach its nearest position to that point, of 26′ 30″ interval, in the year 2095.

The Guardians of the Pole are above the Pole Star, a little to the right of the meridian; below is King Cepheus. Between the constellations of Ursa Minor (the Little Bear) and Gemini, all along the horizon, there is noticeably a comparative blankness of the sky, while other portions of the visible celestial sphere are rich in stars.

Midway between the Bears, right across the meridian, is stretched Draco (the Dragon), with its head close to Vega; the two stars γ and β (not named on the Map) form the eyes in the Dragon's head.

Ursa Major (the Great Bear) has gone past the meridian, having its tail uppermost; it is still high up in the celestial vault, in the N. N. W. This constellation is only second in importance to that of Orion, and is easily recognized in the sky. It has in its composition 7 principal stars, 6 of the 2nd magnitude and 1 (δ) of the 3rd, which go to make up what is known as 'The Plough'; 4 of these stars, in the form of a trapezium, are situated in the body of the Bear, and 3 form the tail; the middle star, ζ (Mizar), of the tail is a double.

Arcturus (the Watcher of the Bear) is almost exactly on the zenith ; and Spica (the Ear of Corn) is some 30° to its S. S. W. Both these stars are of the first-magnitude, and shine out brilliantly ; the former is a bright orange, in colour, and is travelling through space, towards Virgo, at an enormous velocity of about 200 miles per second, and is situated at a distance from the Earth of about 30 times that of the nearest known star, α Centauri ; the latter lies at an immense distance in space from us, for its parallax, up to the present, is undeterminable.

Deneb (the Tail of the Swan) and Altair (the Soaring Eagle) are just risen in the N. E. and E.; while the Twins, Castor and Pollux (the Sons of Zeus and Leda), are about setting in the N. W. The complete cross of Cygnus (the Swan) is now seen above the horizon, lying almost horizontal.

Vega (the Swooping Eagle), the fiery red Antares (the Rival of Mars), and Regulus (the Little King) are showing up well some 30° above the horizon, in the N. E., S. E. and W.; these constitute the chief stars of the constellations of Lyra, Scorpio and Leo.

Alphecca (the Broken Platter) of the Northern Crown, is some 20° from the zenith, E. N. E. Below is Hercules (the Kneeling Man) ; and to his right are Ophiuchus and Serpens *(the Serpent-Bearer and the Serpent).*

Libra is on the meridian, S. ; it forms the 7th of the Zodiacal Constellations, but 8th of the Signs. The *constellation* of Libra is now in the *sign* of Scorpio.

Crux (the Southern Cross) is just below Centaurus (the Centaur), on the S., about 20° W. of the meridian ; and, before long, will have altogether passed out of the region of the Map. The principal member, α Crucis, of the constellation is almost touching the horizon. Each of these two constellations contains two stars, α and β, of the first magnitude ; the pair appertaining to Centaurus are separated by the meridian ; all of them are adjacent to the horizon, and thus shine out most brilliantly. The light from α Centauri, the nearest neighbour of the solar system, travelling at a velocity of 186,400 miles per second, would take 4·35 years to reach the Earth ; whereas that from the Sun takes but 8 minutes to come to us, and from the Moon less than 2 seconds ; the star, which is a fine binary, is now known to be 275,000 times as far away as the Sun. β Centauri is practically on the meridian ; light from it takes 108 years to come to us, in colour, it is white, with a tinge of steely blue. The distances from the Earth of stars whose parallaxes have been ascertained, reckoned in light-years (*i.e.*, the period, in years, taken by light to travel), is determined by the equation : $d = \frac{3.262}{p}$, where d is the distance and p the parallax. So that, α Centauri, whose parallax is 0″·75, should be only 25 billion miles away from us.

Hydra (the Water-Snake) is seen twisting eastward, below and almost parallel with the Ecliptic, from near Regulus, where its head is, due W. and just above the horizon, to close to Spica, where its tail ends, a little to the E. of the meridian ; its brightest star, Al Fard (the Solitary One), of the second magnitude and a variable, lies about 10° S. of the Equator. This constellation of the Sea-Serpent, by which name it is also known, coincided with the equinoctial over 4,000 years ago, but has since moved away to its present position owing to the oscillation of the Earth. The space below Hydra is quite bare of conspicuous stars.

Corvus (the Crow) is a little below, and to the right of, Spica, some 20° W. of the meridian; while a little further to the right is Crater (the Cup), followed by Sextans (the Sextant).

To the left of Centaurus is to be found Lupus (the Wolf); below which are seen, only partly above the horizon, Ara (the Altar) and Triangulum Australis (the Southern Triangle).

The N. Galactic Pole is about 20° W. N. W. of the zenith; and the N. Ecliptic Pole is in the N. N. E., some 20° from the N. Pole.

The zodiacal constellations extend from the W. N. W. to the E. S. E., and comprise the following, in consecutive order, *viz.*, Gemini (the Twins), Cancer (the Crab), Leo (the Lion), Virgo (the Virgin), Libra (the Balance), Scorpio (the Scorpion), and Sagittarius (the Archer).

There are no meteoric showers of importance in the month. Minor showers are the θ Boötids, 27th-28th.

THE NIGHT SKY IN JULY.

Star Chart No. IX.

The central Hour Circle of 16 Hours forms the local meridian.

The Ecliptic cuts the Equator some 60° W. b. S. of the zenith, and crosses the meridian at about 20° S. from the Equator.

The Viâ Lactea (Milky Way) is now conspicuous in the sky, and extends, in a slight curve, from the direction of N. E. b. N. to the S. b. W. passing midway between the horizon and the zenith. It begins in Cassiopeia, cuts through Cepheus, Cygnus, Aquila, Ophiuchus, Serpens, Sagittarius, Scorpio, Ara, Lupus and Triangulum Australis, and ends in Centaurus.

The summer constellations are now high up in the heavens. There are 8 first-magnitude stars shining out up in the sky.

Polaris (the North Star) is a little more than 1° to the N. E. b. N. of the celestial pole.

Ursa Minor (the Little Bear) is on the meridian, near the N. Pole, with the Guardians of the Pole, β (Kochab) and its neighbour γ (Al Farkadain), some 20° away from the Pole, and falling W. of the meridian. Ursa Major (the Great Bear) is in the N. W., with the 'Pointers', α (Dubhe) and β (Merak), about 20° above the horizon.

Draco (the Dragon) appears across the meridian, just above the Lesser Bear, with its head not far from Vega, in the N. E., and its tail terminating close to Dubhe.

Queen Cassiopeia (the Lady in her Chair) is just beginning to show herself in the N. N. E., with Cepheus (King) close above her.

The Great Square of Pegasus (the Flying Horse) is commencing to put in an appearance in the E. N. E. Above it is Delphinus (the Dolphin). To the right, appears the constellation of Aquarius, the harbinger of the autumn season.

The bright stars Altair (the Soaring Eagle) in the E., and Deneb (the Tail of the Swan) in the N. E., are well risen; the former, with a parallax of 0"·231, is but 14 light-years distant from us, or about 82 billion miles.

Vega (the Swooping Eagle) and Arcturus (the Watcher of the Bear), in the N. E. and W., are high up in the heavens. Antares (the Rival of Mars) is approaching the meridian south-

ward; the constellation to which it belongs is one of the best defined groups in the sky, and bears some resemblance to the formation it is supposed to represent; its name implies 'similar to Mars', its prototype, although, considering the former is a vast sun and the latter an insignificant satellite, the model should have been the star instead of the planet.

Hercules (the Kneeling Man) is nearing the meridian, and lies between Lyra and Corona; he has his head (α, Ras al Gethi, meaning the Serpent-Bearer's Head) in proximity to that (α, Ras al Hague) of Ophiuchus, one of the old asterisms; α Herculis is a fine specimen of a double star. Near by is Serpens (the Serpent).

Spica (the Ear of Corn), of Virgo (the Virgin), is about 45° from the zenith, in a south-westerly direction; and Regulus (the Little King), of Leo (the Lion), is sinking towards the W. Alphecca, of the Northern Crown, is near the zenith, some 5° N. W.

Scorpio is on the meridian, S.; it forms the 8th of the Zodiacal Constellations, but 9th of the Signs. The *constellation* of Scorpio is now in the *sign* of Sagittarius.

The two extremely bright stars of Centaurus (the Centaur, a fabulous figure of half-man and half-horse), α and β, designated the 'Sentinels of the Cross,' have gone past the meridian and are in close proximity to the horizon in the S. S. W.; they will soon be disappearing from view altogether.

Triangulum Australis (the Southern Triangle) is bisected by the meridian, on the extreme S.; both its southern stars almost touch the horizon; it is, in shape, nearly equilateral. Slightly above, on the left, to the E. of the meridian, is Ara (the Altar); and on the right, to the W. of the meridian, is Lupus (the Wolf).

Between the S. W. and W., alongside of the horizon, and close together, are the constellations of Hydra (the Snake), Corvus (the Crow), and Crater (the Cup); the last-named bears a striking resemblance to the Northern Crown.

The N. Galactic Pole lies half-way between the zenith and horizon, W. N. W.; and the N. Ecliptic Pole is in the N. N. E., some 40° above the horizon.

The zodiacal constellations extend from the W. b. N. to the E. b. S., and comprise the following, in consecutive order, *viz.*, Leo (the Lion), Virgo (the Virgin), Libra (the Balance), Scorpio (the Scorpion), Sagittarius (the Archer), Capricornus (the Sea-Goat), and Aquarius (the Water-Bearer).

The principal meteoric showers are the δ Aquarids, 26th-31st; radiant: Aquarius; characteristic: slow, with long paths. Meteors of the Perseid stream begin to appear this month. Less important showers are the *α* Capricornids, 16th-29th.

THE NIGHT SKY IN AUGUST.

Star Chart No. X.

The central Hour Circle of 18 Hours forms the local meridian.

The Ecliptic meets the Equator due W. and E., in the constellations of Virgo and Pisces; and cuts the meridian some 23° below the zenith, on the S.

The Viâ Lactea (Milky Way) stretches across the face of the sky from the N. N. E. to the S. S. W., and passes within 20° from the zenith on the S. E. side. It goes through Cassio-

peia, Andromeda, Cepheus, Cygnus, Aquila, Ophiuchus, Serpens, Sagittarius, Scorpio, Ara, and Lupus. The Galactic Belt continues to be a prominent spectacle in the night sky.

The autumn constellations are now seen in the E., while the summer constellations are on their way down in the W., the former are an evidence of the wet season. Of the brilliant first-magnitude stars, only 6 are visible in the heavens.

Polaris (the North Star) is a little over 1° to the N. E. b. E. of the celestial pole; its altitude above the horizon approximates the latitude of one's position, and is the most natural star in the northern hemisphere to which mariners turn to indicate the cardinal points.

The bright star Vega (the Swooping Eagle), which is blueish-white in colour, and, with a parallax of 0"·802, 40 light-years distant from us, is high up, and approaching the meridian, N.; its actual distance from the zenith, for latitude 20° N., is 19°; it belongs to the small but very beautiful constellation of Lyra, and will become the Pole Star some 12,000 years hence. The entire solar system is supposed to be moving rapidly in space towards this point in the heavens, at the rate of about 8 miles per second, which should bring us into the constellation of Lyra in about 180,000 years. Vega is supposed to be a sun of enormous bulk, and is estimated to be 100 times brighter than our Sun.

Deneb (the Tail of the Swan) and Altair (the Swooping Eagle) are also well up, in the N. E. and E. S. E. The star (γ Aquilæ) directly above Altair is called Trazed (the Robber), and the one (β Aquilæ) below Alshain (the White Falcon). The red star Antares (the Rival of Mars) is midway between the zenith and horizon, in the S. W.; it is a long way from us, for light from it takes so much as 155 years to traverse the distance separating it from the Earth, Arcturus (the Watcher of the Bear), the 4th brightest star in the heavens, and Spica (the Ear of Corn) are going down towards the W.

The constellation of Cassiopeia (the Lady in her Chair) is just risen in the N. N. E., and that of Ursa Major (the Great Bear) will soon be disappearing in the N. N. W. The 'Pointers', β-α (Dubhe), are at the bottom, and point to the Pole Star; while the 3 stars of the tail of the Great Bear, ϵ (Alioth), ζ (Mizar), and η (Benetnasch), curve away at the top. Ursa Minor (the Little Bear), near the N. Pole, is still intersected by the meridian; to its right is King Cepheus.

Draco (the Dragon) has its head almost on the meridian, and twists round just above the Lesser Bear till its tail reaches to alongside of Dubhe; the brightest of the 4 stars (of which 3 alone appear on the Map), *viz.*, γ Draconis, which go to form the head of the Dragon, is the zenith star of Greenwich (Lat.=51° 29′ N.; Dec.=51° 30′ N.).

Andromeda (the Chained Lady) is partly risen above the horizon in the N. E.; and to her right, but higher up, is Pegasus (the Flying Horse) whose Square is now completely in view.

On the E. of Altair is Delphinus (the Dolphin), familiarly known as 'Job's Coffin'; and E. of Antares is a long curved row of stars forming the head and claws of the Scorpion.

Ophiuchus (the Serpent-Bearer) is astride the meridian, with his head at α, close to the zenith; Serpens crosses it from W. to E., and forms the only instance in which a constellation is divided.

The 5 stars, arranged in the shape of a Cross, of Cygnus form the wings, head and tail of the Swan. A short distance to the left of Deneb there suddenly appeared, in August 1920,

a New Star, Nova Cygni. On first discovery its magnitude was estimated at 3·5, and gradually increased till in 4 days its maximum of 1·8 was attained; in another month's time the light *declined to 6·0, after which it was no longer visible to the naked eye. The rise to maximum* of Novæ, so far as is known, occurs only once in their history. Generally the Nova appears in the place of a star of faint magnitude, already catalogued, which apparently blazes out into conflagration in the space of a few hours. Most of the recorded Novæ, some 16 in all, made their appearance within the limits of the Via Lactea. The most conspicuous of these temporary stars, so-called, which have appeared in recent times are those of Nova Persei (1901) and Nova Aquilæ (1918), and were for a time even brighter than a first-magnitude star. Of earlier date, was a remarkable star of this kind which appeared in Cassiopeia in 1572, and whose light for a time equalled that of the planet Venus when at its brightest. These outbursts of Novæ are unexplained, but are probably due to the collision of two stars, or the passage of a star through a nebula.

Corona Borealis (the Northern Crown), which is a feature of the sky, is a small and exceedingly striking chaplet of stars, situated between Boötes (the Herdsman) and Hercules (the Kneeling Man); but only its brightest star, Alphecca (the Broken Platter), is shown on the Map.

Sagittarius is on the meridian, S.; it forms the 9th of the Zodiacal Constellations, but 10th of the Signs. The *constellation* of Sagittarius is now in the *sign* of Capricornus.

The well-known first-magnitude star Fomalhaut (the Fish's Mouth), belonging to Piscis Australis (the Southern Fish), appears only just above the horizon, in the S. E. To the right are Indus (the Indian), Pavo (the Peacock), and Ara (the Altar). Yet more to the right, close to the horizon, are Lupus (the Wolf) and Centaurus (the Centaur).

The N. Galactic Pole, which is only a token, and not a reality, up in the sky, now appears low down, near the horizon, in the N. N. W. In this region there is almost a total absence of stellar objects, while there is an abundance in the neighbourhood of the Galaxy. The N. Ecliptic Pole, which is likewise but a symbol, is exactly on the meridian, nearly 30° from the N. Pole.

The zodiacal constellations extend from the W. to the E., and comprise the following, in consecutive order, *viz.*, Virgo (the Virgin), Libra (the Balance), Scorpio (the Scorpion), Sagittarius (the Archer), Capricornus (the Sea-Goat), Aquarius (the Water-Bearer) and Pisces (the Fishes).

The principal meteoric showers are the Perseids, 11th-13th; radiant: Perseus (*see* Chart XI); characteristic: swift, streaks, rich annual showers; this stream of meteors is, after the Leonids, the most interesting and attractive of the year; the orbit of this great star shower is identical with the orbit of Comet III of 1862. Minor showers are the o Draconids, 15th-25th; and ζ Draconids, 21st August-2nd September.

THE NIGHT SKY IN SEPTEMBER.

Star Chart No. XI.

The central Hour Circle of 20 Hours forms the local meridian.

The Ecliptic cuts the meridian about 40° S. of the zenith, and also the Equator some 60° E. from the zenith.

The Via Lactea (Milky Way) extends across the face of the sky, in the form of a great semi-circular arch, passing overhead, where it shines out well, from the N. E. b. N. to the S. W. b. S. It goes through Perseus, Cassiopeia, Andromeda, Cepheus, Cygnus, Aquila, Ophiuchus, Serpens, Sagittarius, Scorpio, and Ara. The division of the upper and lower branches begins in Cygnus, and ends in Ara; the upper branch is most brilliant in the section about the star Deneb (in Cygnus), and the lower branch in the section about Sagittarius; in the space between α and γ Cygni is a distinct black gap, which has been termed the Northern 'Coal Sack'.

The autumnal equinox occurs in the month, and the autumn constellations (embracing Capricornus-Aquarius-Pisces) are well seen in the eastern sky. Of first-magnitude stars, there are but 5 visible in the heavens. The Sun at this stage crosses the equinoctial from N. to S. (*see* Chart XIV), and the day and night are consequently everywhere equal; while the Sun appears to rise due E., and set due W. (*see* Charts XIII and XIV); in practice, though, refraction (2 m.) and semi-diameter (1 m.) combine to make the day some 12 m. longer than the night.

The Full Moon of the month, that nearest to the Autumnal Equinox (23rd September), is designated the Harvest Moon in the British Isles, because at this period, in that high latitude, the Moon rises about sun-set at nearly the same hour for several days in succession, due to the small angle that is made by the Moon's orbit with the horizon. Harvest operations are thereby helped, hence the name. The Full Moon which follows the Harvest Moon is called the Hunter's Moon.

The average daily retardation of Moon-rise, owing to the Moon's easterly motion amongst the stars, is about 50 m.; but the rate necessarily varies with latitude. On the occasion of the Full Moon of the month, the retardation for 2 or 3 days on either side of that date is only some 20 m., for a latitude of 60° N. (as in the British Isles), as against some 40 m. for a latitude of 20° N. (as in India). It will thus be evident that in lower latitudes (in, of course, the northern hemisphere) the retardation is not so small as in more northerly positions.

Polaris (the Pole Star) is almost due E., of a little over 1° distant, from the celestial pole; its maximum elongation E., in the middle of the month, occurs at about 8-0 p.m. (local time). It rests on the tip of the tail of Ursa Minor (the Little Bear), which faces W., horizontally.

The bright stars Deneb (the Tail of the Swan), Vega (the Swooping Eagle), and Altair (the Soaring Eagle) are high up, not far from the zenith, in the N. N. E., N. W., and S. S. W. Between Cygnus and Delphinus is located the famous Dumb-bell Nebula. The star α Aquilæ when on the meridian, S., is separated only by 11° from the zenith, in latitude 20° N.

Fomalhaut (the Fish's Mouth) in the S. E., and Antares (the Rival of Mars) in the S. W. are low down; the latter scintillates more brilliantly as it enters the denser strata of the atmosphere near the horizon. Arcturus (the Watcher of the Bear) is about setting in the W. N. W.

Two interesting stars, the variable Algol (the Demon Star) and Mirfak (the Heart of the Rescuer), both of Perseus, are newly risen above the horizon, in the N. E.

The constellation of Cassiopeia (the Lady in her Chair) has come up in the N. N. E., and that of Ursa Major (the Great Bear) is going down in the N. N. W.

Immediately to the right of Cassiopeia is seen Andromeda (the Chainéd Lady), in a recumbent position, with her head near Pegasus (the Flying Horse) and feet close to Perseus (the Rescuer). The stars α (Alpherat), β (Mirach) and γ (Almach), indicate the head, body and feet of the latter Lady, and are in line horizontally. γ Andromedæ is one of the finest double stars in the heavens; the principal is of the 2nd magnitude and of a yellow colour, and the companion of the 5th magnitude and green in colour.

Draco (the Dragon) lies between the Lesser and Greater Bears, having its head near the star Vega and tail close to the star Dubhe; it is separated from Cepheus by the meridian.

Cygnus (the Swan), sometimes called the Northern Cross, whose centre is marked by the star γ, is stretched across the meridian, in the direction N. E.—S.W., just north of the zenith; the upright and cross-rod of the Cross are now about equally inclined to the horizon. Near Deneb, at the apex of the cross, to its right, is seen a small double star, the noted 61 Cygni (so denoted in Flamsteed's Star Catalogue of 1725), the nearest known star in the northern hemisphere, and from which, with a parallax of $0''\cdot37$, the light occupies nearly 9 years to reach the Earth; its distance from us is thus some 50 billion miles. It was the first star whose distance from the solar system was measured; and has only one other star, η Herculis (which appears above the letter H in the name Hercules on the Map), in the northern hemisphere nearer than it, and which, with a parallax of $0''\cdot4$, is 8 light-years away from us. γ Cygni, when on the meridian, N., is exactly 20° from the zenith, in latitude 20° N.

Triangulum Borealis (the Northern Triangle) is close up to Andromeda. Pegasus is high up to the right, having Alpherat (the Belly of the Horse) and Scheat (the Left Foreleg of the Horse) of the Great Square in a vertical line; the constellation itself was known in olden times as 'Nimrod's Steed'. Delphinus (the Dolphin) is overhead, on the meridian S., some 10° below ϵ Pegasi (Enif).

Cetus (the Sea Monster) has begun to show up in the E. To his right is Sculptor (Apparatus Sculptoris, the Sculptor's Workshop), also quite near the horizon. To the right again comes Grus (the Crane). Indus (the Indian) and Pavo (the Peacock) are low down S., on the meridian; and Ara (the Altar) is a short distance to the right, touching the horizon.

Ophiuchus (the Serpent-Bearer) is midway between the zenith and horizon, in the W.; with Serpens (the Serpent) just below it. Hercules (the Kneeling Man) is to the right, and has Corona Borealis (the Northern Crown) underneath.

Above Fomalhaut (known as 7992 in the B. A. Catalogue of Stars of epoch 1850, and also as 24 Piscis Australis in Flamsteed's Catalogue) is seen the constellation of Capricornus, of which the top star (α) of the 3 forming the head of the Sea-Goat, nearest the meridian, is a double, one of the 3rd and the other of the 4th magnitude. Capricornus is on the meridian, S.; it forms the 10th of the Zodiacal Constellations, but 11th of the Signs. The *constellation* of Capricornus is now in the *sign* of Aquarius.

The S. Galactic Pole is immediately above the horizon, in the E. S. E.; and the N. Ecliptic Pole is nearly 50° from the zenith, and about 10° from the meridian, W.

The zodiacal constellations extend from the W. S. W. to the E. N. E., and comprise the following, in consecutive order, *viz.*, Libra (the Balance), Scorpio (the Scorpion), Sagittarius (the Archer), Capricornus (the Sea-Goat), Aquarius (the Water-Bearer), Pisces (the Fishes), and Aries (the Ram).

There are no meteoric showers of importance in the month. Minor showers are the Piscids, 5th-15th; and α Andromedids, 28th.

THE NIGHT SKY IN OCTOBER.

STAR CHART NO. XII.

The central Hour Circle of 22 Hours forms the local meridian.

The Ecliptic cuts the meridian at about 30° S. of the zenith, and also the Equator some 30 S. E. from the zenith.

The Viâ Lactea (Milky Way) stretches across the heavens, in a gentle curve, from the N. E. to the S. W., passing some 30° from the zenith in the N. W. direction; its two branches separate in the Great Cross, of the Swan, just below Deneb. It successively crosses Auriga, Perseus, Cassiopeia, Andromeda, Cepheus, Cygnus, Aquila, Ophiuchus, Serpens, Sagittarius, and Scorpio.

The autumn constellations are now high up in the heavens. There are so few as 4 first-magnitude stars which shine out up in the sky.

Polaris (the North Star) is a little over 1° S. E. of the celestial pole; it lies at the extremity of the tail of Ursa Minor (the Little Bear), whose second important star β (Kochab) is situated on its right shoulder, and which now faces W.

Immediately above the Pole there stands erect on the meridian Cepheus (King), with the heel of his left foot resting on Polaris.

Draco (the Dragon) twists round the Lesser Bear, on its left, with its head facing W., and not far from Vega.

The bright star Capella (the Goat) has made its appearance over the horizon in the N. E., and Mirfak (the Heart of the Rescuer) is some 15° vertically above it. Algol (the Demon Star) is close to these, on the right; this remarkable short-period, and regular, variable, of nearly 3 days, usually appears of the second magnitude, for it only remains a fourth-magnitude for some 20 minutes; it belongs to a small class of stars whose type of variation is characteristic; such stars are partially eclipsed by a dark companion revolving round them; and Algol is the typical star, which has given its name to the group.

Deneb (the Tail of the Swan), Vega (the Swooping Eagle), and Altair (the Soaring Eagle) are still well up in the sky, on the W. of the meridian. These stars appertain to the constellations Cygnus (the Swan), Lyra (the Harp), and Aquila (the Eagle). γ Cygni, in the centre of the Great Cross, marks the body of the Swan; the adjoining, and vertically placed, stars, above (ε) and below (δ), represent the right and left wings; while the horizontally placed stars, to the left (β) and right (α), known by the names of Alberio and Arided (or Deneb), stand for the beak and tail. Alberio is one of the finest specimens of double stars in the firmament; it is of a yellowish hue, while its smaller companion has a blue tint.

Delphinus (the Dolphin) is to the left of the Cross. Much below comes Hercules (the Kneeling Man). On his left, in part only over the horizon, are Ophiuchus (the Serpent-Bearer) and Serpens (the Serpent).

The cluster known as the Pleiades (of the Bull) have risen in the E. N. E.; these consist of a loose conglomeration of bright stars of which 6 are easily counted without artificial aid, though a keen sight may be able to distinguish 3 more, or 9, in all, while others are visible only through a telescope. This group of stars is a special feature of the coming winter months, and forms a prominent mark in the eastern sky in the late evenings of the present month; the principal members are known by the names of the mythological Atlas and Pleione, and their 7 daughters; the brightest of them is Alcyone, which is about 150 times brighter than the Sun. The constellation of Taurus heralds the winter months; in olden times, too, its well-known asterism of the Pleiades was taken as the precursor of the winter stars; its acronical rising (or rising at sun-set) marked the beginning of winter.

Exactly overhead is seen the winged horse Pegasus; the Great Square formed by the 4 stars Alpherat (the Belly), Scheat (the Left Foreleg), Markab (the Saddle), and Algenib (the Side), lying E. N. E.; the first two of these being almost in a vertical line.

Aquarius is on the meridian, S.; this forms the last but one (or 11th) Constellation, but the last (or 12th) Sign, of the Zodiac. The *constellation* of Aquarius is now in the *sign* of Pisces.

Fomalhaut (the Fish's Mouth) is low down, in the S. S. E., not far from the meridian; on reaching the meridian, it will have attained its greatest elevation (from S.) of 40°, in latitude 20° N. Alphecca (the Broken Platter), of the Northern Crown, is about disappearing in the W. N. W.

The great constellation of Cetus (the Sea-Monster) is stretched across the equator, having the variable Mira (the Wonderful Star), of the long period (331 days in this case) type, almost touching the equinoctial. It is the most extensive group, of mostly small stars, in the heavens.

The constellation of Cassiopeia (the Lady in her Chair) is now well up in the N. N. E.; it is unmistakable in the sky by reason of its 5 bright stars that go to form the letter W, which always faces the N. Pole.

The fair Andromeda (the Chained Lady), in her golden chains, floats in space above and betwixt Cassiopeia and Pegasus, midway between the zenith and horizon. Immediately below is Triangulum Borealis (the Northern Triangle).

Along the southern horizon, from the E. S. E. to the S. S. W., either actually touching or not far from it, are seen the less conspicuous constellations of Eridanus (the River), Fornax

(the Furnace), Sculptor (the Sculptor's Workshop), Phœnix (the Phœnix), Toucan (the Toucan), Grus (the Crane), Pavo (the Peacock), and Indus (the Indian).

More to the W. are apparent Scorpio and Sagittarius. In the latter constellation there exists a very beautiful nebula, which is visible to the naked eye on a clear, moonless night; its position on the Map is indicated by the black dot shown above the first letter A in the name Lactea which appears there.

The S. Galactic Pole and the N. Ecliptic Pole have shifted slightly to the W.; the former is in the S. E., and the latter in the N. N. W., each about 30° from the horizon.

The zodiacal constellations extend from the W. S. W. to the E. N. E., and consist of the following, in consecutive order, *viz.*, Scorpio (the Scorpion), Sagittarius (the Archer), Capricornus (the Sea-Goat), Aquarius (the Water-Bearer), Pisces (the Fishes), Aries (the Ram), and Taurus (the Bull).

The principal meteoric showers are the Orionids, 18th-25th; radiant: Orion (*see* Chart I); characteristic: swift, streaks; a well-marked shower. Minor showers are the Arietids, 12th-25th.

Astronomical Terms.

Aberration.—Sun: the difference between the true and apparent longitude of the sun. Star: the alteration of position caused by the earth's motion in its orbit.

Acceleration.—See *Retardation.*

Achromatic.—Free from colour; applied to an object-glass in which rays of different colours are brought to the same focus.

Acronical.—Rising at sun-set, or setting at sun rise; culminating at midnight; the opposite of *cosmical.*

Aerolite.—A meteoric stone or other body falling from the celestial spaces.

Altitude.—The arc of a vertical circle passing through a celestial object, contained between the object and celestial horizon. The altitude as seen from the surface of the earth is the 'apparent altitude,' and what it would be if seen from the centre of the earth is its 'true altitude.' The altitude of the pole (celestial) is equal to the latitude (terrestrial) of the place.

Amplitude.—The arc of the celestial horizon contained between the east or west point and a vertical circle passing through a celestial object.

Angle of the Vertical.—The small angle by which the real direction of the earth's centre from any point on its surface differs from that which is directly downward, as indicated by the plumb-line. It is due to the ellipticity of the earth, and its greatest value is about 12′ at the latitude of 45°, while it is zero at the equator and poles.

Angular Distance.—See *Arc.*

Annular.—Having the appearance of a ring; ring-shaped.

Annular Stellar Parallax.—The difference in the direction of a star as seen from the sun and from one extremity of the earth's orbit; that is, the angle which the radius of the earth's orbit would subtend if seen from the star.

Anomalistic.—Pertaining to the anomaly, or angular distance of a planet from its perihelion.

Anomaly.—The angular distance of a planet from its perihelion, as seen from the sun.

Aphelion.—The point in a planet's orbit most distant from the sun.

Apogee.—The point in the moon's orbit furthest from the earth, or in the earth's orbit furthest from the sun.

Apsides.—The two points of an orbit which are at the greatest and least distances from the central body; the line joining the two points is the 'line of apsides'.

Arc and Angular Distance.—A part of a great circle. The arcs of all great circles are proportional to the angles they subtend at the centre of the sphere; hence the arc is often used to designate the angle; and the angle is often called the 'angular distance' between the extremities of the arc.

Aries, First Point of (♈).—The Vernal (or Spring) Equinox, to the meridian of which all heavenly bodies are referred. The sun enters the *Sign* Aries at this period, about the 21st March.

Ascending Node.—Applied to a planet when, in its orbit, it crosses the ecliptic from S. to N.

Astronomical Almanac.—See *Ephemeris.*

Astronomy.—The science of the stars and other heavenly bodies.

Aurora Borealis.—A luminous meteoric phenomenon in the northern hemisphere, visible only at night, and supposed to be of electrical origin. The region of greatest frequency is the neighbourhood of the Arctic Circle, and it appears to have some connection with the magnetic pole. The 'Aurora Australis' is a corresponding phenomenon in the southern hemisphere.

Axis, Celestial.—The axis of the celestial sphere is the axis of the earth produced both ways to meet the celestial sphere, about which the heavenly bodies appear to revolve.

Axis, Terrestrial.—The imaginary straight line about which the earth rotates from west to east; also called the 'axis of rotation.'

Azimuth.—The arc of the celestial horizon contained between the north or south point and a vertical circle passing through the object; it is usually reckoned from the north, westward, *i.e.*, by the way of the east, south and west.

Binary System.—A double star in which the two components are found to revolve round each other.

Calendar.—An arrangement of the divisions of time, as days, weeks, months, etc.

Calendar Moon.—The Moon as represented in the chronological system.

Cancer, Sign of (♋).—The summer solstice. The sun enters the *Sign* Cancer at this period, about the 22nd June.

Capricorn, Sign of (♑).—The winter solstice. The sun enters the *Sign* Capricornus at this period, about the 22nd December.

Circumpolar Star.—Any star the whole of whose diurnal circle, at the given place, is described above the celestial horizon, *i.e.*, which never sets; or, whose polar distance is not greater than the latitude of the place.

Clusters, Star.—Groups or condensations of stars situated in various parts of the heavens, including the galactic belt; some of these are visible to the naked eye, like the *Pleiades*; others appear as milky patches of light visible only in powerful telescopes.

Colures.—Two great circles intersecting at right angles in the poles of the equator, and passing respectively through the equinoctial and solstitial points.

Comet.—A heavenly body with a train of luminous matter, which moves round the sun in mostly parabolic orbits, or of elongated ellipses, and is only visible when in proximity to the sun.

> **"As when a comet far and wide descried,**
> **In scorn of Phœbus 'midst bright heaven doth shine**
> **And tidings sad of death and mischief brings**
> **To mighty lords, to monarchs and to kings.**

Conjunction.—Two celestial bodies are in conjunction when they have the same longitude, or right ascension; *e.g.*, the moon with the sun at the time of new moon.

Constellation.—A group or cluster of the most conspicuous of the fixed stars. The constellations are given mythological names after horses, goddesses, or animals, whose outlines were supposed to be drawn on the sky so as to include the principal stars of the particular constellation.

"Now came still evening on, and twilight grey
 Had in her sober livery all things clad.
* * * now glowed the firmament,
With living sapphires; Hesperus that led
The starry host rode brightest."

Corona.—The exterior envelope of the sun, being beyond the photosphere and chromosphere, invisible in the telescope except during a total eclipse.

Cosmical.—Rising or setting with the sun; culminating at midday; the opposite of *acronical.* Relating to phenomena which have their origin outside the earth and its atmosphere.

Culmination.—The time at which stellar bodies cross the meridian; designated 'upper' or 'lower' culmination, according as the star is in its highest or lowest position.

Cusps.—The points or horns of the moon or of a planet when in the form of a crescent.

Cycle.—An interval of time in which recur certain aspects or phenomena of the celestial bodies, as the Metonic Cycle.

Day, Astronomical.—Begins at the moment the true sun's centre is on the meridian, *i.e.* at noon of the corresponding Civil Day.

Note.—The Astronomical Day, from the year 1925 begins like the Civil Day, with which it now corresponds, at midnight. The term "Greenwich Mean Time", in the Nautical Almanac, will then be considered to be the Standard time of the meridian of Greenwich, commencing at *midnight* and reckoned throughout the 24 hours.

Day, Civil.—In the civil, or common, method of reckoning, the day commences at the preceding midnight, and is counted only to 12 hours or noon, when the 12 hours are reckoned over again to the next midnight. The civil reckoning is therefore always 12h. in advance of the astronomical reckoning.

Note.—The Civil Day is now counted up to 24 hours, reckoned from midnight to midnight.

Day, Lunar.—The interval between the departure and return of a meridian to the moon; it is of variable length, and may equal [in 1908] from about 25h. 4m. 48s. to about 24h. 41m. 0s.

Day, Sidereal.—The interval between the departure and return of a meridian to a star, *i.e.*, the time in which the axial rotation of the earth is performed; it equals 23h. 56m. 4·09s. of mean solar time.

Day, Solar (Mean).—The interval between the departure and succeeding return to the mean sun; it equals 24h. 3m. 56·56s. of sidereal time. The length of a mean solar day is equal to the mean or average of all the apparent solar days in a year.

Day, Solar (True or Apparent).—The interval between the departure and return of a

meridian to the true sun; it is of variable length, and may equal [in 1908] from about 24h. 14m. 25s. to about 23h. 43m. 40s. of mean time.

Day, Week, Month or Year.—The numerical day, commencing with the first day of the week, month or year, is known as the week-day, month-day, or year-day.

Declination.—The arc of a celestial meridian contained between the celestial object and the equinoctial; it is reckoned N. or S. from 0° to 90°, according as the object is in the northern or southern hemisphere. Declination (Dec., or δ) in a celestial object corresponds to latitude in a terrestrial.

Declination Circle.—See *Meridian, Celestial.*

Descending Node.—Applied to a planet when, in its orbit, it crosses the ecliptic from N. to S.

Diameter.—Any straight line passing through the centre of a sphere and limited on each side by the surface of the sphere.

Digit.—The twelfth part of the diameter of the sun or moon, formerly used to express the magnitude of eclipses.

Dip of the Horizon.—The angular depression of the visible horizon below the true, or sensible, horizon, as at sea.

Direct Motion.—The movement, as seen from the earth, of a planet (or comet) from west to east among the stars.

Disc.—The visible surface of the sun, moon and larger planets.

Diurnal Arcs.—Those parts of the parallels of declination which appear to be described between the rising and the setting of a celestial object.

Dominical (or Sunday) Letter.—It serves to find the day of the week on which any particular day of the month in a year will fall. The series consists of the letters A to G which correspond to the days of the week. The letter corresponding to Sunday of any year is called the Dominical, or Sunday, Letter for that year. If the Dominical Letter for the year be A, Jan. 1=A, 2=B, 7=G, 8=A, etc. A leap year, owing to the intercalary day, has two letters assigned to it; the first is used up to the 29th February, and the second for the remainder of the year.

Earth.—The planet inhabited by man; it revolves round the sun in 365d. 5h. 48m. 45·51s. It is one of the major planets of the solar system.

[The mean distance of the earth from the sun is 92,897,000* miles, and its mean diameter is 7,912 miles.† The eccentricity of its orbit is equal to 0·0168, or about $\frac{1}{60}$.]

"But when earth's silent footfall steals
Along the eastern sky,
And one by one to earth reveals
Those purer fires on high,
When one by one each human sound
Dies on the awful ear,
Then Nature's voice no more is drowned,
She speaks and we must hear."

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* *Note.*—The most recent results, based on a solar parallax of 8''·80905, are as follows, *viz.*, aphelion distance=94,353,155 miles, perihelion distance=91,240,754 miles, and mean distance=92,796,950 miles.

† *Note.*—The latest values give the equatorial diameter of the earth at 7,927 miles, and the polar distance at 7,900 miles.

Easter Day.—In both the old and new styles Easter Day is the Sunday following that *fourteenth* day of the *calendar* moon which happens *upon* or *next after* the 21st March, so that if the said 14th day be a Sunday, Easter Day is not that Sunday, but the next.

Eccentricity.—The distance of the centre of the orbit of a celestial body from the centre of the body round which it revolves, expressed as a fraction of the semi-axis major.

Note.—If a represent the semi-major axis, c the semi-minor axis, e the eccentricity, and b the distance of the Sun from the centre of the orbit; then, as $b : a :: a : e$; $e = \frac{a^2}{b}$; $b = \frac{a^2}{e}$; also, $c = \sqrt{a^2 - b^2}$.

Eclipse.—The obscuration of a heavenly body by the interposition of another body; *e.g.*, the sun by the moon when new, or the moon when full by the earth, known, respectively, as solar or lunar eclipses. An eclipse occurs only when the moon, at conjunction or opposition, is also near one of her nodes.

> "The Sun to darkness turns, the Moon to blood—
> Strange signs by ignorance misunderstood;
> Prognostics dire with superstition base,
> On these fleet shadows o'er Creation's face.
> To Science all is light: she reaps fresh store
> Of knowledge where 'twas mystery before."

Ecliptic.—The apparent path of the sun round the earth; *i.e.*, the earth's orbit round the sun. The ecliptic is so called as eclipses occur only when the moon is in or near that plane. The place of a celestial object is fixed by its latitude and longitude, referred to the ecliptic; it can also be determined by its declination and right ascension, referred to the equinoctial.

Egress.—See *Ingress.*

Elements.—The data or values for predicting astronomical phenomena.

Ellipticity.—Deviation of an ellipse or a spheroid from the form of a circle or sphere, as the case may be.

Elongation.—The period at which the inferior planets are at their greatest angular distance, E. or W., from the sun, as seen from the earth.

Emersion.—The reappearance of a celestial body after an eclipse or occultation.

Epact.—The moon's age on the first day of the year or month; it is the excess of the solar year or month beyond the lunar. The annual epact is the excess of the solar year over the lunar year; and the monthly epact is the excess of a calendar month over a lunar.

Ephemeris.—A collection of tables giving the quantities and positions of celestial bodies for each day of the year. An Astronomical or Nautical Almanac.

Equation of the Centre.—The difference, or angular distance, between the place of a planet as moving in an ellipse, and its mean position or place as supposed to move uniformly in a circle.

Equation of Time.—See *Time.*

Equatorial.—A telescope so mounted as to have two axes of motion, one parallel and the other at right angles to the axis of the earth, and each carrying a graduated circle for mea-

suring declination and right ascension, respectively, of a star or other celestial object. With such an instrument a star may be followed in its apparent diurnal course.

Equator, Terrestrial.—A great circle of the earth, equidistant from the poles; and which divides the sphere into the northern and southern hemispheres.

Equinoctial and Solstitial Colures.—The celestial meridians respectively passing through the equinoctial and the solstitial points. The solstitial colure is at right angles both to the ecliptic and to the celestial equator, for it cuts both these circles 90° from their common intersection; that is, from the equinoctial points.

Equinoctial or Celestial Equator.—A great circle of the heavens formed by producing the plane of the terrestrial equator to meet the celestial sphere. It is equidistant from the celestial poles, and divides the celestial sphere into the northern and southern hemispheres. The place of a celestial object is determined by its declination and right ascension referred to the equinoctial; it can also be fixed by its latitude and longitude, referred to the ecliptic.

Equinoxes.—The points (equinoctial) of intersection of the ecliptic with the celestial equator, termed 'vernal' or 'autumnal' according as the sun appears to cross the equinoctial towards the north or south, about the 21st March or 23rd September, respectively.

Establishment of the Port.—The interval which elapses between noon and the time of high water at new and full moon.

Evection.—An inequality of the moon in its orbit, due to the attraction of the sun whereby she oscillates about 1° 20′ on either side of her mean position; the libration of the moon.

Evening Star.—Any planet when not far from the sun, and which sets soon after it in the western sky.

> "O Hesperus! thou bringest all good things—
> Home to the weary, to the hungry cheer,
> To the young bird the parents' brooding wings,
> The welcome stall to the o'er-labour'd steer."

Eye-piece.—The lens, or combination of lenses, at the eye-end of a telescope, through which the image formed by the mirror or object glass is viewed.

Faculæ.—Groups of small shining spots on the surface of the sun which are brighter than the other parts of the photosphere. They are generally seen in the neighbourhood of the dark spots, and are supposed to be elevated portions of the photosphere.

Focus.—A point in which the rays of light meet, after being reflected or refracted, and at which the image in a telescope is formed.

Full Moon.—The Moon is said to be *Full* when it is in opposition to the sun. Its whole disc is then illuminated.

Galaxy.—The Milky Way, *viâ* Lactea, or the Galactic Belt. A luminous tract, or belt, which is seen at night stretching across the heavens, and which is composed of innumerable, and extremely distant, stars.

> "A broad and ample road whose dust is gold,
> And pavement stars, as stars to thee appear
> Seen in the galaxy, that milky way
> Which nightly as a circling zone thou see'st
> Powdered with stars."

Geocentric.—Reckoned from the centre of the earth.

Geodesy.—The measurement with great exactness of the earth's surface by combined astronomical observations and triangulation. One minute of arc on the earth's surface is reckoned as a 'nautical' mile, which is equal to $1\frac{1}{8}$ of a 'statute' mile, nearly.

Geometric Projection.—A perspective projection in which the point of sight is outside the sphere, and the surface represented is that cut off by a plane parallel to the projection plane, and the boundary is therefore a circle.

Gibbous.—The slightly rounded form of the sun, moon and larger planets presented on their dark sides, or unenlightened faces, at certain stages of their orbits; in the case of the moon between full (at opposition) and quadrature, and of planets between elongations and superior conjunction or opposition.

Gnomon.—The style of a sun-dial, the shadow of which is measured in order to learn the position of the sun.

Gnomonic Projection.—A projection of the circles of the sphere, in which the point of sight is taken at the centre of the sphere, and the principal plane is tangent to the surface of the sphere. It may be a polar, meridian, or horizontal, central projection.

Golden Number.—The position in the Metonic or 19-year cycle (lunar) held by any particular year; that is, the number which each year bears in the Cycle of Meton. The golden number is 1 in every A.D. year which is exactly divisible by 19; in other words, to find the golden number divide the number of the year by 19 and add 1 to the remainder.

Great Circle.—That whose plane passes through the centre of the sphere, and divides it into two equal parts or hemispheres.

Halo.—A circle of light round the moon or sun. It is produced by the refraction of light from clouds of ice spicules at great elevations.

Harvest Moon.—The moon, near the full at the time of harvest, or about the autumnal equinox, when, by reason of the small angle that is made by the moon's orbit with the horizon, it rises nearly at the same hour for several days.

"In the deep stillness of the night,
When weary labour is at rest,
How lovely is the scene! how bright
The wood, the lawn, the mountain's breast,
When thou, fair moon of harvest! hast
Thy radiant glory all unfurl'd,
And sweetly smilest in the west,
Far down upon the silent world."

Heavens.—The expanse of space surrounding the earth, especially that which seems to be over the earth like a great arch or dome; the sky; the place where the sun, moon and stars appear.

"Lift up your eyes on high, the heavens behold
The Sun rides flaming in his car of gold.
The Moon by night refulgent gilds the sky,
The starry host shines forth in majesty.
The planets beam resplendent in their spheres;
Divinest harmony midst all appears.
Glorious the scene, and will the watcher find
Each orb a lesson to the enquiring mind.
Though silent all, those radient armies tell,
Of one great Hand that doeth all things well."

Heliacal.—Emerging from, or passing into, the light of the sun. Applied in former times to those risings or settings of bright stars which took place as near to sunrise or sunset as they could be observed.

Heliocentric.—Reckoned from the centre of the sun.

Heliostat.—An instrument consisting of a mirror moved by clockwork so as to reflect the rays of the sun in a fixed direction during his diurnal motion.

Heliotrope.—An instrument used in geodetic measurements for throwing the sun's rays in the direction of a station of observation.

Horizon, Celestial.—A great circle in the heavens formed by producing the rational horizon (the line that bounds the sight) to meet the celestial sphere.

Horizon, Rational.—A plane that passes through the centre of the earth, parallel to the sensible horizon.

Horizon, Sensible.—A plane that is tangent to the earth at the given place.

Horizontal Parallax.—The angle under which the equatorial semi-diameter of the earth would appear at the centre of the celestial object concerned, *e.g.*, the sun or moon; it is used for reducing an observation of the celestial object to what it would be if made at the centre of the earth.

Horizon, Visible.—The circle which bounds that part of the earth's surface visible to a spectator from a given point; the apparent junction of the earth and sky. The visible horizon is always below the sensible horizon.

Hour Angle.—The angle at the celestial pole between the hour circle passing through it and the celestial meridian of the given place; in other words, the arc on the equinoctial contained between the great circles passing through the object and the zenith. The angle is reckoned positively from the upper culmination westward, from 0° to 360°.

Hour Circle.—See *Meridian, Celestial.*

Hunter's Moon.—The lunation after the harvest moon.

Immersion.—The disappearance of a celestial body, by passing behind another, or into its shadow.

Inclination of Orbit.—The angle which the path of a planet makes with the plane of the ecliptic.

Inclination of the Earth's Axis.—The angular distance of the earth's axis from the vertical to its orbit; it is equal to the angle which the equator makes with the ecliptic; its value is 23°27′. [22nd June 1921 = 23° 26′ 49″·5; 22nd December 1921 = 23° 26′ 48″·3. See *Obliquity of the Ecliptic*].

Inferior Conjunction.—The position of an inferior planet when between the earth and the sun.

Inferior Planets.—Those which revolve inside the orbit of the earth.

Ingress and Egress.—The moment at which the inferior planets visibly enter upon the sun's disc is called the 'ingress,' and that at which they take their departure off the disc the 'egress'.

Latitude, Celestial.—The angular distance of a celestial object from the ecliptic as taken along a great circle at right angles to the plane of the ecliptic towards the poles of the heavens, N. or S., and reckoned from 0° to 90°.

Latitude, Terrestrial.—The angular distance from the equator, north or south, measured on the meridian of the given place on the earth's surface; it (*Lat., or* λ) cannot exceed 90°. If the place is north of the equator, it is termed north latitude; if south, south latitude. It is the complement of the distance of the place from the pole, which is called the 'co-latitude'.

Libra, First Point of (♎).—The Autumnal (or Autumn) Equinox. The Sun enters the *Sign* Libra at this period, about the 23rd September.

Libration.—The apparent swinging or oscillating motion of the moon about her axis, like that of a balance before coming to rest.

Light-year.—The distance in space that light would travel in a year, at a velocity of 186,400 miles per second; or, close upon 6 (more correctly, 5·88) billion miles. Light takes 8 minutes to reach the earth from the sun. [A Light-year = $5 \cdot 88 \times 10^{12}$ Miles = 3·3 Parsecs; a Parsec (distance for 1″ parallax) = $19 \cdot 2 \times 10^{12}$ Miles.]

[According to the most recent determination, the velocity of light is 186,414 is miles per second.]

Longitude, Celestial.—The angular distance of a celestial object measured on the ecliptic from the vernal equinox, or First Point of Aries, reckoned, in the order of the signs, from 0° to 360°.

Longitude, Terrestrial.—The angular distance of the meridian of the given place on the earth's surface from some fixed meridian (*e.g.*, of Greenwich) to which all longitudes are referred, east or west, measured on the equator; it (*Long., or L.*) cannot exceed 180°. A place to the east of Greenwich is said to have 'east longitude', and to the west, 'west longitude'.

Lunation.—The interval between two successive new moons; it is by this period that the various phases of the moon are regulated. The time of new moon is the moment when the longitude of the moon's centre is equal to that of the sun's centre.

Magnitude.—Has reference to the stars which are classified according to their brilliancy, or magnitude, and not to their absolute size which is in most cases unknown. Those visible to the naked eye on a clear and moonless night, are divided into 6 classes, the most brilliant being those of the 1st magnitude.

"And one star differeth from another star in glory."

Magnitude of Illumination.—The fraction of the whole disc, as applied to planets, that is illuminated. When the fraction is less than 0·500 the planet is ***horned***, when greater it is ***gibbous***; and when it is 1, the disc is Full.

[The expression 'magnitude of illumination' has reference to the illuminated portion of the disc of planets, and is given in the N. A. for Mercury and Venus for every 5th day of the month, the number furnished being the versed sine of the illuminated portion of the disc, the apparent diameter of the planet being taken as unity.]

Mass.—The quantity of matter contained in a celestial body, as measured by its weight.

Mean Distance.—The average of the distances throughout one revolution of a planet round the sun, equivalent to the semi-major axis of the orbit.

Meridian, Celestial.—A great circle which the sun crosses at noon, and which passes through the celestial poles at right angles to the equinoctial; also called 'hour' or 'declination circle'.

Meridian, Terrestrial.—A great circle passing through the poles of the earth, at right angles to the equator.

Meteor.—A cometary body which becomes luminous through friction caused by its passage through the earth's atmosphere.

> "Our lights dart here and there, whirl to and fro,
> We flash and vanish, we die down and glow;
> All doing His will Who bids us do it so."

Metonic Cycle.—A cycle of the moon, or lunar cycle; a period of 19 solar years, or 235 lunations, after the lapse of which the new and full moon returns to the same day of the year; so called from Meton, who first proposed it.

Micrometer.—An instrument, used with a telescope, for measuring minute distances of the apparent diameters of objects which subtend small angles.

Month, Anomalistic.—The period covered by the return of the moon to perigee; that is, to her nearest approach to the earth; it consists of 27d. 13h. 18m. 37·44s.

Month, Calendar.—A period varying from 28 to 31 days; it is derived from the synodical revolution of the moon, the mean value of which is 29d. 12h. 44m. 2·86s., *i.e.*, the mean synodic month.

Month, Dracontic.—The interval between two successive passages of the moon through the ascending node of her orbit with the ecliptic; it consists of 27d. 5h. 5m. 35·81s.

Month, Sidereal.—The period covered by the return of the moon to the vicinity of the same stars; it consists of 27d. 7h. 43m. 11·55s.

Month, Synodic or Lunar.—A period in which the moon goes through every variety of phase, as from one conjunction to another; *e.g.*, the interval between two successive full moons; it consists of 29d. 12h. 44m. 2·86s. (mean value).

Month, Tropical.— The period occupied by the moon in its passage from equinox to equinox; it consists of 27d. 7h. 43m. 4·68s.

Moon.—A satellite of the earth, round which it revolves once in 29d. 12h. 44m. 2·86s. (termed a synodic revolution of the moon). A sidereal revolution of the moon is performed in 27d. 7h. 43m. 11·55s. The duration of the moon's rotation on her axis corresponds with that of her revolution round the earth; hence she always presents the same face to the earth, the other half being invisible.

[The mean distance of the moon from the earth is 238,840 miles*, its diameter is 2,163 miles, and its mean velocity is 3,337 feet per second. The eccentricity of its orbit is 0·0549, or about $\frac{1}{18}$.]

> "Fair in the vault of heaven, so fair, O Moon,
> Thou beamest, and—most strange, most beautiful—
> Dost change these earthly scenes to fairyland—
> Such magic in thy silvery radiance lies."

Moon's Age.—The date of the lunar month reckoned from new moon; the day on which

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*Note.—The latest results give the maximum distance, or apogee, at 231,068 miles, minimum distance, or perigee, at 225,742 miles, and mean distance at 238,855 miles.

the moon is new, though it may occur just before midnight, is called the first day of the moon.

Morning Star.—Any planet when not far from the sun and which rises shortly before it in the eastern sky.

> " Fairest of stars ! Thou crown'st the smiling morn
> With thy bright circlet."

Multiple Stars.—Double, triple and multiple stars consist of 2, 3 and 4 or more component stars, respectively. Where the two stars of a pair revolve round each other, they are called *binary stars.*

Nadir.—The point in the heavens directly below at a place ; hence opposite to the zenith.

Nautical Almanac.—See *Ephemeris.*

Nebulæ.—Masses of glowing gas in the heavens, considered to be in process of formation into stars and systems, as they gradually cool and condense. The remarkable regularity of the solar system is thus explained, and known as the 'nebular hypothesis'.

> " Some tumultuous cloud
> Instinct with fire and nitre."

New Moon.—The Moon is said to be *New* when it is in conjunction with the sun. It is then in its first quarter.

Nocturnal Arcs.—The parts of the parallels of declination which appear to be described between the setting and the rising of a celestial object.

Nodes.—The points at which the orbit of a planet intersects the ecliptic.

Nutation.—Sun (in R. A.) : the quantity by which the true equinox differs from its mean place. Star : the oscillatory motion of the earth's axis.

Oblate.—A round body which is flattened or depressed at the poles, as the earth which is an oblate spheroid.

Obliquity of the Ecliptic.—The inclination of the plane of the ecliptic with that of the equinoctial, *viz.*, 23° 27′ 4·5″ [mean, in 1908]. The obliquity fluctuates within the limits, approximately, of 22° and 24½° ; it is at present diminishing at 47″ per century. [See *Inclination of the Earth's Axis*].

Occultation.—The eclipsing of one celestial body by another ; *e.g.*, the fixed stars and planets by the moon.

Old and New Style.—The old, or Julian, style is used for any year up to 4th October 1582 A.D., and the new, or Gregorian, style from 15th October 1582; the interval from 5th to 14th October 1582 was non-existent though the week days were continuous, October 4th being Thursday and October 15th Friday. For Russia and all Greek Churches the old style alone is used.

Old Moon.—The phenomenon known as "the Old Moon in the New Moon's arms" occurs when the moon is only a few days old and appears in the form of a thin crescent ; this is due to that part of the moon which is not directly lit by the sun being faintly seen by the reflected 'earth-light.'

Opposition.—Two celestial bodies are in opposition when they have a difference in longitude of 180° ; *e.g.*, the moon to the sun at the time of full moon.

Orbit.—The path described by a planet (or comet) round the sun.

Parallax.—The angle made at a celestial object between the position of the observer and the centre of the earth ; *i.e.*, the angular difference of the apparent from the true altitude of the celestial object. The correction for parallax is *additive*, as applied to altitude.

[The parallax of a star is usually expressed by the angle under which the radius or semi-diameter of the terrestrial orbit is seen from the star. A star whose parallax should be 1″ would indicate a distance of 206,265 × 93 millions of miles (= 19 billions of miles), etc. The distance of any star is reckoned from the formula $\frac{206,265\ R}{p}$, where R is the radius of the terrestrial orbit, and p the parallax. Light years $= \frac{3.262}{p}$, where p is the parallax.]

Parallels.—Imaginary circles on the earth or in the heavens parallel to the equator (terrestrial or celestial), with the poles (terrestrial or celestial) as centres.

Penumbra.—The partial shadow cast in an eclipse by the intervening body between the umbra, or deep shadow, and the full light.

Perigee.—The point in the moon's orbit nearest the earth, or in the earth's orbit nearest the sun.

Perihelion.—The point in a planet's orbit nearest the sun.

Perturbation.—A disturbance in the regular elliptic or other motion of a celestial body, produced by some force other than that which causes its regular motion. The perturbations of planets are caused by their attraction on each other.

Phase.—The varying apparent shape of the moon and the interior planets, due to a portion of the illuminated half of their surfaces being turned towards the earth ; the exterior planets only assume a slightly gibbous appearance.

Photometer.—An instrument for estimating the intensity of light.

Planet.—A celestial body of the solar system which revolves in a regular orbit about, and derives its light from, the sun ; a 'wandering star'. The orbits of all planets are ellipses, with the sun in one focus.

> "*Or near or far, or great or small,*
> One Hand controls them each and all."

Polar Axis.—That axis of an astronomical instrument, as an equatorial, which is parallel to the earth's axis.

Polar Circles.—Two circles, each at a distance from a pole of the earth equal to the obliquity of the ecliptic, or about 23°27′, the northern called the 'arctic circle' and the southern the 'antarctic' circle. These parallels of latitude are 66°33′ N. or S., from the equator. At the northern position the sun does not set below the horizon on the day of the summer solstice, nor rise above the horizon on the day of the winter solstice ; the reverse is the case at the southern position.

Polar Distance.—The arc of a celestial meridian contained between a celestial object and the pole. It is the complement of the declination ; and is known as the 'north' or 'south polar distance', according as the object is in the northern or southern hemisphere.

Poles, Celestial.—The extremities of the axis of the celestial sphere, termed the N. and S. poles. The north pole is near the Pole Star (*Stella Polaris*), or *Polaris.*

> "I'm constant as the Northern Star,
> Of whose true—fixed and vesting quality
> There is no fellow in the firmament."

Position Angle.—The angle which the sun's axis makes with the meridian passing through the sun's centre to the east (+) or west (—) of the disc ; it is zero on the 5th January and 6th July, and greatest (±26°20′) on the 10th October and 5th April.

Precession.—A slow retrograde motion of the equinox from east to west along the ecliptic. The precession of the equinoxes is due to the gradual change in the direction of the earth's axis in space.

Prime Vertical.—A vertical circle of the celestial sphere perpendicular to the meridian of a place, and therefore passing through the east and west points of the celestial horizon. The meridian of the place intersects the celestial horizon in the north and south points.

Proper Motion.—An apparent movement of the stellar region due to a slow motion of the solar system in space. The apex of the sun's motion is supposed to be in the region of the constellation Lyra, in the neighbourhood of the star Vega (*a* Lyræ).

Quadrature.—Two celestial bodies are in quadrature when they have a difference in longitude of 90°. When a planet is in quadrature with the sun, *east* or *west*, it comes on to the meridian about 6 hours *after* or *before*, as the case may be, of the sun.

Radiant Point.—That point in the sky whence meteoric showers, or shooting stars in great number, emanate.

Radius Vector.—An imaginary line drawn from the sun to a planet's place at any time.

Rainbow.—A solar or lunar rainbow is an optical meteorological phenomenon of frequent occurrence consisting of a coloured arch, or arches, formed opposite the sun or moon on falling rain drops, and visible whenever the necessary conditions of passing shower on one side and a clear and not too high sun or moon on the other occur ; it is merely a reflection of a ray of light from the sun or moon to the rain shower as seen by the observer. Lunar rainbows are feebler than solar rainbows, due to the feebleness of the moon's light owing to which there is usually an absence of colour in them ; a lunar rainbow is a somewhat rare phenomenon.

> " For, faithful to its sacred page,
> *Heaven still re-builds thy span,*
> Nor lets the type grow pale with age
> That first spoke peace to man."

Refraction.—The angular distance between the apparent and true places of a celestial object. Refraction is caused by a ray of light from a celestial object entering the earth's atmosphere, whereby it is bent downwards, and the curve is proportional to the density. The correction for refraction is *subtractive*, as applied to altitude.

Retardation and Acceleration.—A meridian of the earth returns to the same star in a Shorter interval than it does to the sun ; the difference, expressed in mean time, is called the 'retardation' of mean on sidereal time ; and when expressed in sidereal time, it is called the 'acceleration' of sidereal on mean time.

Retrograde Motion.—The movement, as seen from the earth, of a planet (or comet) from east to west among the stars.

Right Ascension.—The arc of the equinoctial contained between the Vernal Equinox (First Point of Aries) and the celestial meridian passing through the celestial object; it is reckoned eastward, from 0h. to 24h. The eastward direction refers to the fixed stars, but with

reference to the apparent diurnal motion of the heavens the direction would be westward. Right Ascension (R. A., or △) in a celestial object corresponds to longitude in a terrestrial.

Rising and Setting.—The appearance above or disappearance below, as the case may be the visible horizon of a celestial object, *e.g.*, the sun, moon, stars or planets.

Saros.—A period or cycle of 18 years 11 days, in which eclipses recur; that is, in which there are 19 returns of the sun and 242 returns of the moon to the same node.

Satellite.—An attendant small planet revolving rouud its principal, usually in an easterly (or direct) direction; *e.g.*, the moon round the earth.

Scintillation.—The twinkling, or sparkling, of the fixed stars.

Secular.—Pertaining to changes in distant periods of time in the orbits of planets, as secular inequality.

Selenography.—The science that treats of the physical features of the moon.

Semi-diameter.—The angle at the centre of the earth subtended by the sun's or moon's semi-diameter; it is required for reducing observations of the limb to the centre, as in the measurement of altitudes, or, in the case of the sun, of the distance of the moon from the sun, or, in the case of the moon, of lunar distances. The correction for semi-diameter is ***subtractive*** or ***additive***, as applied to altitude, according as the *upper* or *lower* limb of the object (sun or moon) is observed.

Setting.—See *Rising.*

Sextant.—The sixth part of tbe circle. An instrument employed in navigation for determining the angular distance between two objects, or the altitude of a celestial object.

Sidereal.—Relating to the stars. Measurement by the apparent motion of the stars, or by a return to the same position in respect to the stars; *e.g.*, the sidereal revolution of a planet, or a sidereal day. Sidereal time is the time measured by the diurnal revolution of the stars.

Signs of the Zodiac.—The twelve equal parts into which the ancients divided the ecliptic or zodiac. The signs are reckoned from the point of intersection of the ecliptic with the equator at the vernal equinox. In consequence of the precession of the equinoxes, the signs have, in process of time, become separated about 30 degrees from the constellations, and each of the latter now lies in the sign next in advance, or to the east of the one which bears its name, as the constellation Aries in the sign Taurus, etc. The *Signs* of the Zodiac, thus, should not be confounded with the Zodiacal *Constellations.*

Small Circle.—That whose plane does not pass through the centre of the sphere, and which divides it into two unequal parts, the one greater and the other less than a hemisphere.

Solar Cycle.—Consists of a period of 28 years, and is based npon the recurrence of the day of the week upon the same day of the month. In the year 1896 the solar cycle was 1, *i.e.*, the first year of one of these periods.

Solstices.—The middle points (solstitial) of the northern (summer) and southern (winter) sections of the ecliptic, with reference to the celestial equator, and through which the sun passes about the 22nd June and 22nd December, respectively.

Solstitial Colure.—See *Equinoctial Colure.*

Sound.—Travels in still air at $1,089{\cdot}42\sqrt{1+{\cdot}00208\,(F^\circ-32)}$ feet per second; it increases 1·15 feet per degree Fahrenheit. Its velocity through the air varies with temperature, pressure, etc., and is accelerated or retarded by wind.

Southing.—The time at which planetary bodies cross the meridian; so called because these bodies are then due south.

Speculum.—The concave mirror of a reflecting telescope.

Sphere.—A surface, or globe, every part of which is equally distant from a point within called the 'centre'. The apparent surface of the heavens, which is assumed to be spherical and everywhere equally distant, in which the heavenly bodies appear to have their places: the celestial sphere. The figures representing the constellations were originally drawn on spheres, or celestial globes. They are therefore reversed, the stars being supposed to be viewed from the centre of the sphere, *i.e.*, the earth regarded as a point.

[The surface of a sphere varies as the square of the radius, and light inversely as the square of the distance].

"The heavens declare the glory of God,
And the firmament showeth His handiwork."

Standard Time.—The central or standard meridians adopted, for convenience, by various countries, are in hour or half-hour zones, *i.e.*, at intervals of 15° or 7½° east or west of the prime meridian of Greenwich. The standard meridians for India and for Burma are 82° 30′ E. and 97° 30′ E., and the corresponding standard times, therefore, are 5½ hours E. and 6½ hours E. of Greenwich, respectively.

Star.—A luminous body in the heavens; a distant sun. The term 'fixed stars' implies that owing to their remote distance from the solar system the stars are practically fixed in place.

"No unregarded star
Contracts its light
Into so small a character,
Removed far from our human sight,
But if we steadfast look
We shall discern
In it, as in some holy book,
How man may heavenly knowledge learn."

Stationary.—Applied to the periods of a planet, between direct and retrograde motions, or *vice versâ*, when it does not appear to move relatively to the stars.

Stereographic Projection.—A representation of the sphere in which the centre of projection is taken in the surface of the sphere, and the plane upon which the projection is made at right angles to the diameter passing through the centre of the projection. It has three aspects: polar, meridian, and horizontal.

Sun.—The centre of the solar system, of which the earth forms part; it gives light and heat to the surrounding planets. The entire solar system is moving towards the constellation Lyra*, at a velocity of about 10 miles per second.

[* *i.e.*, to a point of the sky situated in R. A. 18 h. 34 m., Dec. 38° 42′ N.]

[The axis, around which the sun rotates, is inclined to the ecliptic at an angle of 82° 45', and the inclination of the sun's equatorial plane to the ecliptic is thus 7° 15'; in other words, the sun's axis is inclined at an angle of 7° 15' to the perpendicular to the ecliptic. From 3rd June to 5th December the plane of the ecliptic is north of the sun's equator, and thus for this half of the year the sun's north pole is on the visible side of the sun, and in the other half of the year its south pole is visible.]

"Th' unwearied sun, from day to day,
Does his Creator's power display;
And publishes, to every land,
The work of an Almighty Hand."

Sun-rise.—First appearance (apparent) of the sun (*i.e.*, of its upper limb) above the eastern horizon in the morning.

Note.—At times, in Almanacs and Calendars, and elsewhere, the *centre* (apparent) is taken for both Sun and Moon.

"At last, the golden Oriental gate
Of greatest heaven 'gan to open fair,
And Phœbus, fresh as bridegroom to his mate,
Came dancing forth, shaking his dewy hair,
And hurl'd his glitt'ring beams thro' gloomy air."

Sun-set.—Disappearance (apparent) of the sun (*i.e.*, of its upper limb) below the western horizon in the evening.

Note.—At times, in Almanacs and Calendars, and elsewhere, the *centre* (apparent) is taker for both Sun and Moon

"The weary sun hath made a golden set,
And, by the bright track of his fiery car,
Gives token of a goodly day to-morrow."

Superior Conjunction.—The position of an inferior planet when the sun is between the earth and the planet.

Superior Planets.—Those whose orbits are outside that of the earth.

Synodic.—Pertaining to the period between two successive conjunctions, as of the moon or a planet with the sun.

Syzygy.—The points of the moon's orbit in which it is either new moon or full moon. The line of syzygies is that which passes through these points, crossing the orbit of the moon.

Telescope.—An optical instrument for viewing distant objects. An apparatus used in connection with observations of celestial and terrestial objects whereby, by an arrangement of lenses and other devices and attachments, various minute phenomena are capable of being accurately measured. A refracting telescope is one in which the image is formed by a lens or achromatic combination of lenses. A reflecting telescope is one in which the image is formed by a concave mirror. An achromatic telescope is one in which the object glass is composed of two lenses of opposite curvatures and of different kinds of glass, so that an image practically destitute of colour is obtained. An equatorial telescope is one so mounted as to follow a star in its diurnal motion.

Terminator.—The dividing line between the illuminated and unilluminated part of the moon or a planet.

Time, Equation of.—The angular distance in time between the mean and the true sun, The difference, + or —, between apparent and mean time at any instant; it is a variable quantity, and may equal up to about 16m.

Time, Greenwich.—Applies to Greenwich with reference to the meridian passage of the sun (true or mean), or of the First Point of Aries (♈); it may be solar (apparent or mean) or sidereal. The meridian of Greenwich is the prime meridian to which all other meridians, local or standard, east or west of it, are referred.

Time, Local.—Applies to a given place with reference to the meridian passage of the sun (true or mean), or of the First Point of Aries (♈); it may be solar (apparent or mean), or sidereal.

Time, Mean.—The hour angle of the sun reckoned westward from oh. to 24h. (mean solar intervals). Mean time cannot be obtained from observation; but it may be readily deduced from an observation of the true sun, with the aid of the equation of time. Clocks and chronometers are adjusted to mean solar time.

Time, Sidereal.—The hour angle of the First Point of Aries (♈) reckoned westward from oh. to 24h. (sidereal intervals). The sidereal time at mean noon (or, the R. A. of the mean sun) is the angular distance of the First Point of Aries, or the true vernal equinox, from the meridian, at the instant of mean noon.

Time, Solar (True or Apparent).—The hour angle of the sun's centre reckoned westward from oh. to 24h. (solar intervals).

"The Moon shall look down with a tearful eye,
And the Sun shall withhold his fire,
And the hoary earth, all parched and dry,
Shall flame for his funeral pyre,
When the Angel, that standeth on earth and shore,
Proclaimeth that 'Time shall be no more'!"

Transit.—The passage of an inferior planet (Mercury or Venus) over the sun's disc, or of a star across the celestial meridian of a place.

Twilight.—The light perceived before the rising, and after the setting, of the sun, or when the sun is less than 18° below the horizon, occasioned by the illumination of the earth's atmosphere by the direct rays of the sun and their reflection on the earth.

Umbra.—The conical shadow projected from a planet or satellite, on the side opposite to the sun, within which no portion of the sun's disc is visible.

Variable Stars.—Stellar objects whose light diminishes at regular or irregular intervals, due to an eclipse by a dark or bright companion, *e.g.*, Algol (in the constellation Perseus).

Vertical Circle.—A great circle of the heavens which passes through the zenith and nadir, and cuts the celestial horizon at right angles.

Weight.—The comparative force, or intensity of gravity, with which a celestial body tends towards the surface of the earth.

Year, Anomalistic.—Denotes the time between two successive passages of the earth through its aphelion and perihelion points, and consists of 365d. 6h. 13m. 48·09s.

Year, Calendar or Common.—Contains 365 days.

Year, Leap or Bissextile.—Contains an extra day, and consists of 366 days; it occurs every fourth year, except centuries other than those divisible by four without remainder.

Year, Lunar.—The period in which the moon goes through 12 synodic or lunar months; it consists of 354d. 8h. 48m. 34·37s.

Year, Luni-solar.—A period of time at the end of which the new and full moons and the eclipses of the year recur on the same days of the week and month and year as in the previous period. It consists of 532 common years, being the least common multiple of the number of years in the cycle (28 years) of the sun and the cycle (19 years) of the moon.

Year, Sidereal.—Denotes the time between two successive passages of a star across the celestial meridian passing through the vernal equinox (First Point of Aries); in other words, is the period covered by the return of a star to transit across a given meridian at the same mean solar time; it consists of 365d. 6h. 9m. 8·97s.

Year, Solar or Tropical.—The period in which the sun moves from the vernal equinox to the vernal equinox again; *i.e.*, it marks the interval of time between two passages of the sun through the tropics, or equinoctial points; its average value is 365d. 5h. 48m. 45·51s.

Zenith.—The point in the heavens directly overhead at a place.

Zenith Distance.—The arc of a vertical circle contained between a celestial object and the zenith. It is the complement of the altitude. The meridional zenith distance is usually denoted by the algebraic sign + or —, according as the celestial object is south or north of the zenith.

Zodiac.—A zone of the heavens extending to about 8° on either side of the ecliptic, and within which the sun (apparent), moon and principal planets have their motions.

"Our vernal signs the Ram begins,
Then comes the Bull, in May the Twins;
The Crab in June, next Leo shines,
And Virgo ends the northern signs,
The Balance brings autumnal fruits,
The Scorpion stings, the Archer shoots;
December's Goat brings wintry blast,
Aquarius rain, the Fish come last."

Zodiacal Light.—A luminous tract of the sky, of an elongated triangular figure, lying near the ecliptic, its base being on the horizon, and its apex at varying altitudes. It is to be seen only in the evening, after twilight, and in the morning before dawn. It is supposed to be due to sunlight reflected from multitudes of meteoroids revolving about the sun nearly in the plane of the ecliptic. Immediately opposite to the sun there is a faint light in the heavens called the 'Gegenschein', or counter-glow.

Mythological Names.

(Of some of the chief Constellations.)

Andromeda.—A daughter of Cepheus and Cassiopeia. She was tied naked on a rock, exposed to the fury of the Sea-monster, to appease the wrath of Neptune, but was delivered by Perseus. Minerva is said to have made Andromeda a constellation in heaven after her death.

Aquarius.—The eleventh sign of the Zodiac (now in the constellation of Capricornus), which the Sun enters about the 19th January. Some suppose that Ganymede (a goddess, better known by the name of Hebe) was changed into this sign.

Argo Navis.—The Ship is composed of four different parts : Malus, Vela, Puppis and Carina. In Greek legend, Jason and his companion heroes the Argonauts sailed away in this vessel to recover the Golden Fleece.

Aries.—The first sign of the Zodiac (now in the constellation of Pisces), which the Sun enters at the vernal equinox (spring) about the 21st March.

Bootes.—Supposed by some to be Icarius, an Athenian, the father of Erigone, who was killed by shepherds for inebriating them; others maintain that it is Arcas, a son of Jupiter and Calisto, whom Jupiter placed in heaven.

Cancer.—The fourth sign of the Zodiac (now in the constellation of Gemini), which the Sun enters at the summer solstice, about the 22nd June. Placed in the heavens by the goddess Juno as a recognition of its help in doing harm to Hercules in his fight with the monster Hydra.

Capricornus.—The tenth sign of the Zodiac (now in the constellation of Sagittarius), which the Sun enters at the winter solstice, about the 22nd December. *In this constellation appear 28 stars in the form of a goat, supposed by the ancients* to be the goat Amelthœa, which fed Jupiter (the most powerful of all the gods of the ancients) with her milk.

Cassiopeia.—Married Cepheus, by whom she had Andromeda. She boasted herself to be fairer than the Nerides; upon which Neptune, at the request of these despised nymphs, punished the insolence of Cassiopeia, and sent a huge sea-monster to ravage Aethiopia. The wrath of Neptune could be appeased only by exposing Andromeda, whom Cassiopeia tenderly loved, to the fury of the sea-monster; and just as she was going to be devoured, Perseus rescued her.

Centaurus.—Son of Apollo, by Stilbia, daughter of the Peneus. The offspring of Centaurus, the Centauri, were half men and half horses.

Cepheus.—A King of Aethiopia, father of Andromeda by Cassiopeia. He was one of the Argonauts, and was changed into a constellation after his death.

Cetus.—The Sea-Monster destined by Neptune for the destruction of Aethiopia, and who was overcome by Perseus when about to devour Andromeda.

Coma Berinices.—Daughter of Philadelphus and Arsinœ, who, when her husband went on a dangerous expedition, vowed all the hair of her head to the Goddess Venus, if he returned safely. Some time after his victorious return, the locks which were in the temple of Venus disappeared; and it was then publicly reported that Jupiter had carried them away, and had made them a constellation.

Cygnus.—A son of Neptune, invulnerable in every part of his body. Achilles fought against him, but his darts were of no effect, whereupon he threw him on the ground and smothered him; and then stripped him of his armour only to find him suddenly transformed into a swan.

Delphinus.—Placed among the constellations by Neptune as a reward for having persuaded the goddess Amphitrite to break her vow of perpetual celibacy and become his wife.

Eridanus.—The king of rivers, into which Phaeton dropped when killed by a thunderbolt sent by Jupiter as a punishment for the theft of the sun-chariot. In its neighbourhood the Heliades, the sisters of Phaeton, were changed into poplars.

Gemini.—The third sign of the Zodiac (now in the constellation of Taurus), which the Sun enters about the 21st May. Represents Castor and Pollux, the twin sons of Zeus and Leda, who accompanied Jason in his voyage in search of the Golden Fleece. They were exalted and placed in the heavens as a sign of filial affection.

Hercules.—In classical mythology, a hero or demi-god, son of Jupiter and Alcmena. Renowned for his wonderful achievements, twelve of which are specially singled out as his 'twelve labours.' After his death he was ranked among the gods, and received divine honours.

Hydra.—A many-headed monster of Greek mythology, slain by Hercules in the neighbourhood of the lake Lema.

Leo.—The fifth sign of the Zodiac (now in the constellation of Cancer), which the Sun enters about the 21st July.

Libra.—The seventh sign of the Zodiac (now in the constellation of Virgo), which the Sun enters at the autumnal equinox (autumn) about the 23rd September.

Lynx.—A cruel King of Scythia, who treacherously endeavoured to murder Triptolemus, who was delegated by Ceres to teach mankind agriculture; for which cowardly act he was suddenly changed into a lynx, an animal which is the emblem of perfidy and ingratitude.

Ophiuchus.—Said to be identical with Æsculapius, son of Apollo by Coronis. He was physician to the Argonauts, and so skilled in medicine, that he became the god of medicine. He received divine honours after death.

Orion.—A giant and mighty hunter of Greek fable, who was blinded as a punishment by Œnopion, King of Chios, whom he had displeased; but he recovered his sight by travelling eastwards and exposing his eyes to the rays of the rising sun.

He died from the bite of a scorpion, which the earth produced, to punish his vanity in boasting that there was not on earth any animal which he could not conquer. After death he became a constellation.

Pegasus.—A winged horse sprung from the blood of Medusa when Perseus had cut off her head. As soon as he was born he left the earth and flew up into heaven, and was placed among the constellations by Jupiter. Perseus, according to Ovid, was mounted on the horse Pegasus, when he destroyed the sea-monster which was going to devour Andromeda.

Perseus.—A son of Jupiter and Danæ. While returning through the air from the conquest of the Gorgons, he saw Andromeda in her plight bound on a rock, and was captivated by her beauty. On a promise from Cepheus that he should receive her in marriage as a reward for delivering her from the sea-monster, he destroyed the monster by converting it into a rock through showing him the head of Medusa (which had the property of turning to stone everything, at sight), whom he had himself slain, and untied Andromeda to whom he was subsequently married, and by whom he had several children. He received divine honours, like the rest of the ancient Greeks.

Pisces.—The twelfth sign of the Zodiac (now in the constellation of Aquarius), which the Sun enters about the 19th February.

Pleiades.—A name given to seven of the daughters of Atlas by Pleione. They were placed in the heavens after death, where they formed the constellation called Pleiades, near the back of the Bull All the daughters had some of the immortal gods for their suitors, except Merope who married a mortal; and on that account her star is dim and obscure among the rest of her sisters. The name of the Pleiades is derived from the Greek word 'to sail', because that constellation shows the time most favourable to navigators, which is the spring.

Sagittarius.—The ninth sign of the Zodiac (now in the constellation of Scorpio), which the Sun enters about the 20th November. He is represented by the figure of a Centaur in the act of shooting an arrow from his bow.

Scorpio.—The eighth sign of the Zodiac (now in the constellation of Libra), which the Sun enters about the 20th October. The animal that the earth produced to mortally sting Orion for his vanity in declaring that there was no earthly creature that he could not overcome.

Taurus.—The second sign of the Zodiac (now in the constellation of Aries), which the Sun enters about the 20th April.

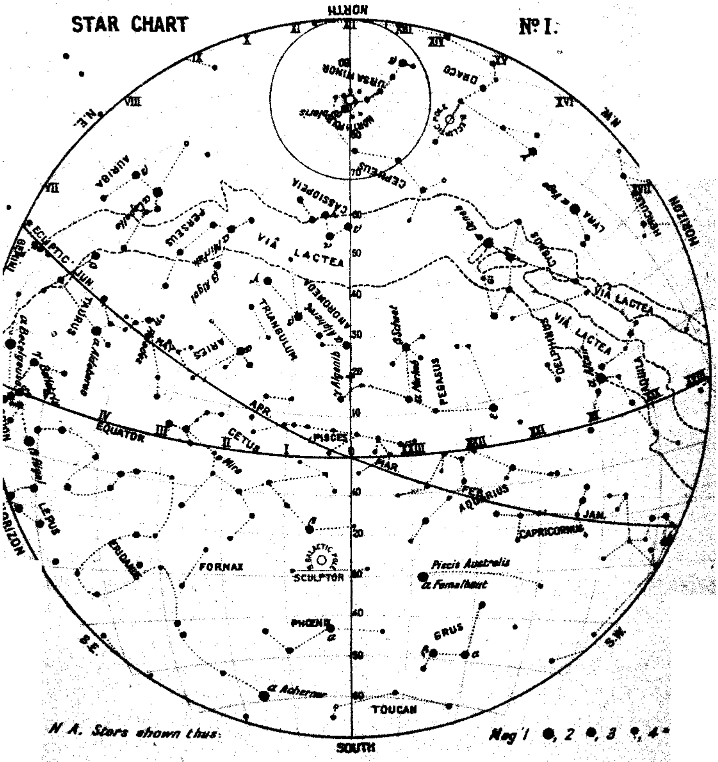
Ursa Major.—Calisto, the daughter of Lycaon, King of Arcadia, was transformed by Juno, through jealousy, into a bear; but Jupiter, the god, apprehensive of harm coming to her through huntsmen, made her a constellation of heaven.

Ursa Minor.—Arcas was the son of Calisto, whom Jupiter converted into a constellation, along with the mother, under the name of the bear.

Virgo.—The sixth sign of the Zodiac (now in the constellation of Leo), which the Sun enters about the 20th August. Erigone, a daughter of Icarius, who hanged herself when she heard that her father had been killed by some shepherds whom he had intoxicated. She was made a constellation, now known under the name of Virgo.

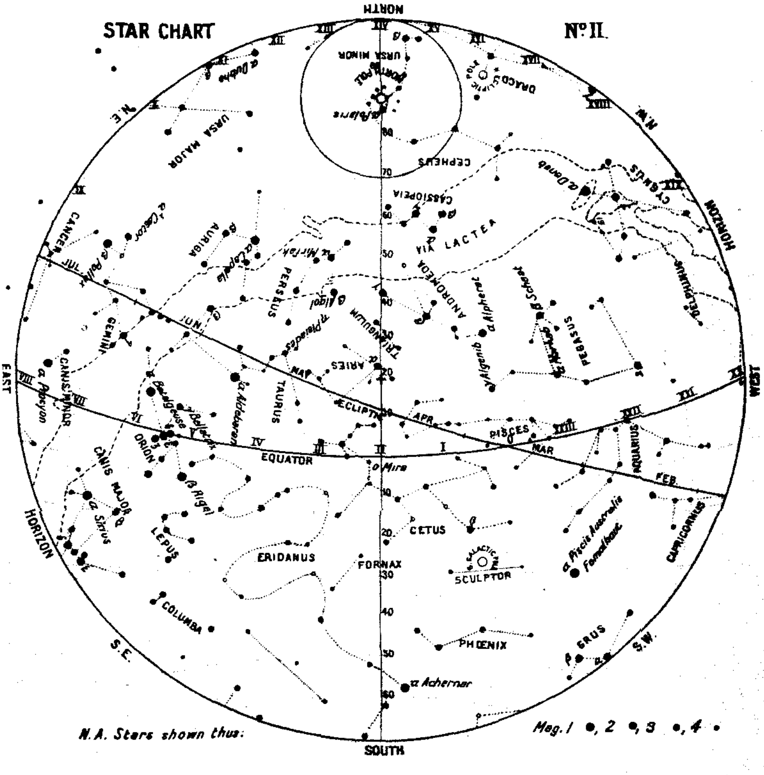
MAPS

NOVEMBER



st, 9·19; 8th, 8·52; 15th, 8·24; 22nd, 7·57; 30th, 7·25 P.M.)

DECEMBER



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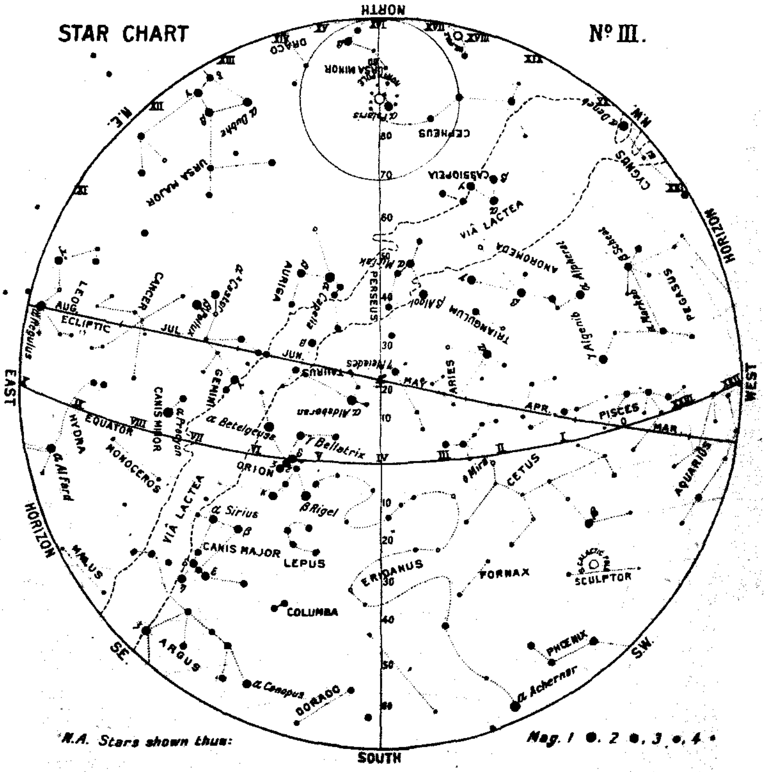
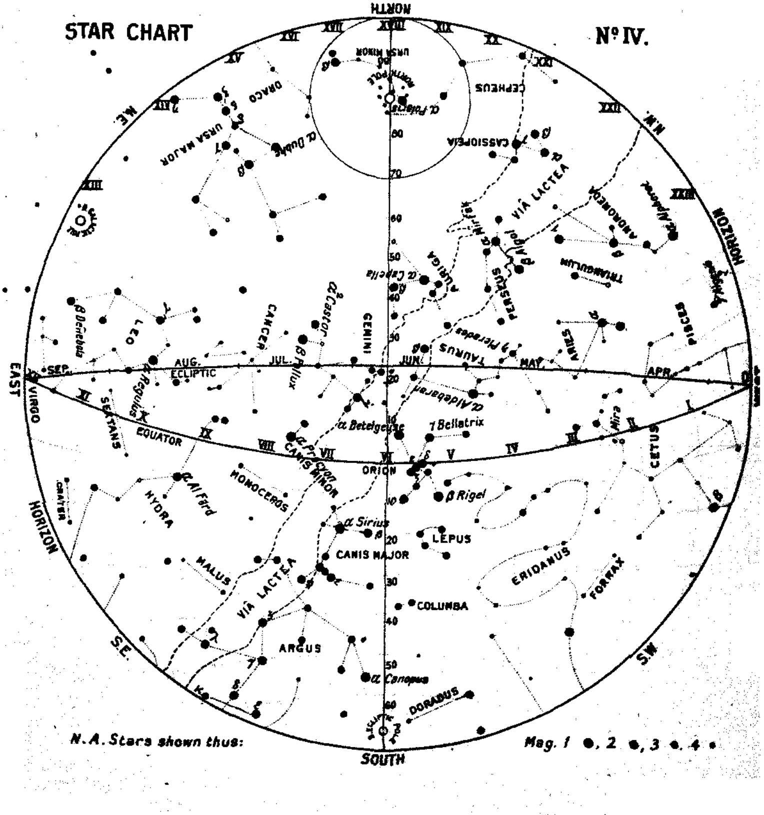
JANUARY



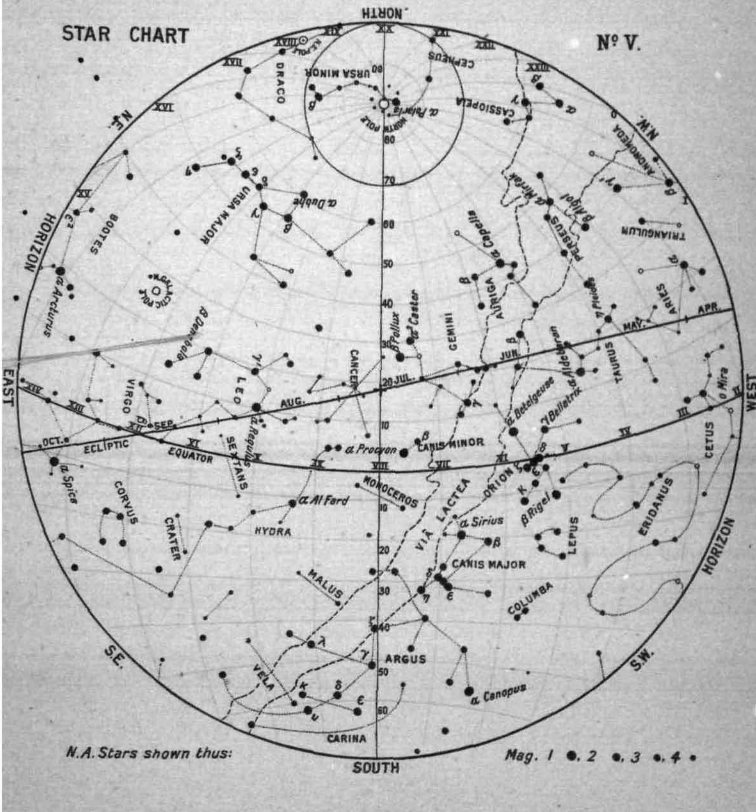
STAR CHART
Nº III.
NORTH
SOUTH
EAST
WEST
N.E.
N.W.
S.E.
S.W.
HORIZON
HORIZON
HORIZON
URSA MAJOR
URSA MINOR
DRACO
CEPHEUS
CASSIOPEIA
CYGNUS
VIÂ LACTEA
ANDROMEDA
PEGASUS
PERSEUS
AURIGA
LEO
CANCER
GEMINI
TAURUS
TRIANGULUM
ARIES
PISCES
AQUARIUS
CETUS
ORION
CANIS MINOR
HYDRA
MONOCEROS
VIÂ LACTEA
CANIS MAJOR
LEPUS
ERIDANUS
FORNAX
SCULPTOR
COLUMBA
ARGUS
PHŒNIX
DORADO
MALUS
ECLIPTIC
EQUATOR
α Dubhe
α Polaris
α Capella
α Castor
β Pollux
α Mirfak
β Algol
α Alpheratz
γ Algenib
α Markab
β Scheat
α Deneb
γ Pleiades
α Aldebaran
α Betelgeuse
γ Bellatrix
β Rigel
α Sirius
α Procyon
α Alfard
α Regulus
α Mira
α Canopus
α Achernar
AUG.
JUL.
JUN.
MAY
APR.
MAR.
N.A. Stars shown thus:
Mag. 1 ● . 2 ● . 3 ● . 4 •

FEBRUARY



(1st, 9-16; 8th, 8-49; 15th, 8-21; 22nd, 7-54; 28th or 29th, 7-29 P.M.)

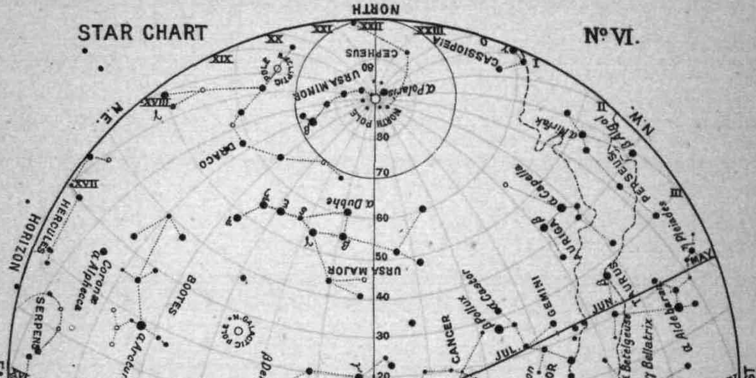
MARCH



(1st, 9-25; 8th, 8-57; 15th, 8-30; 22nd, 8-2; 31st, 7-26 P.M.)

APRIL

STAR CHART Nº VI.



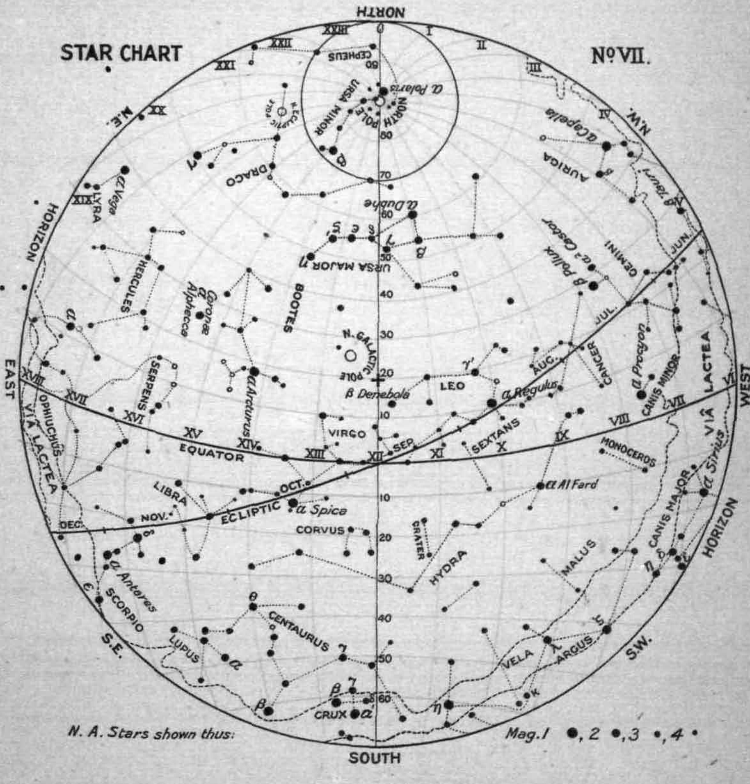
N.A. Stars shown thus:

Mag. 1 ●, 2 ●, 3 ●, 4 •

(1st, 9-23; 8th, 8-55; 15th, 8-28; 22nd, 8-0; 30th, 7-29 P.M.)

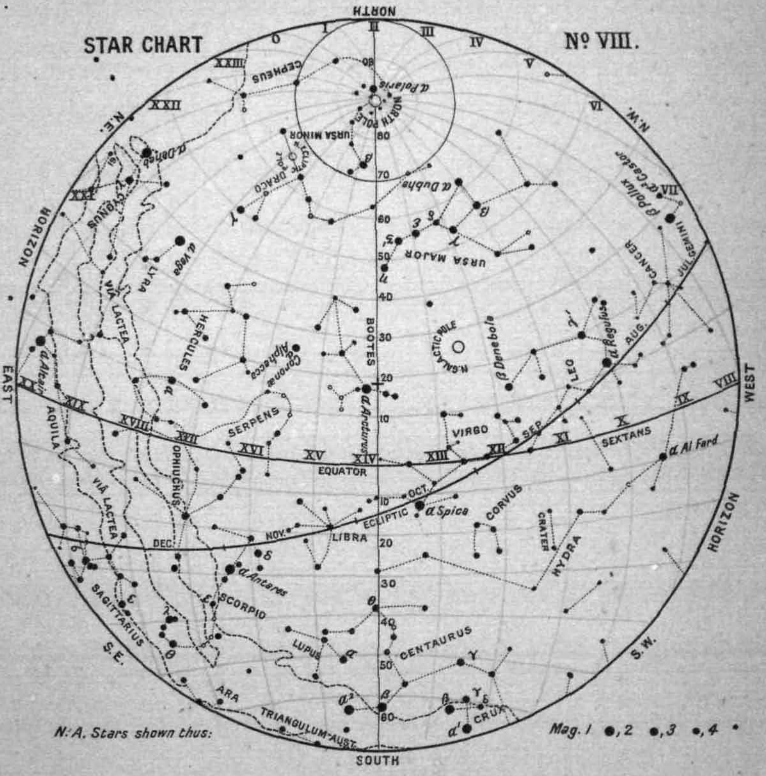
MAY

STAR CHART Nº VII.



(1st, 9-25; 8th, 8-57; 15th, 8-29; 22nd, 8-2; 31st, 7-27 P.M.)

JUNE



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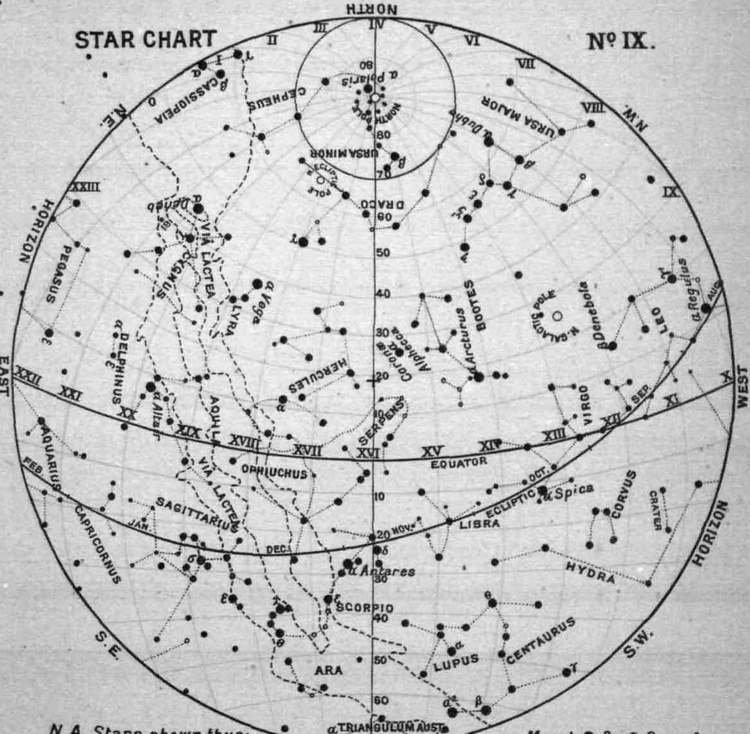
JULY



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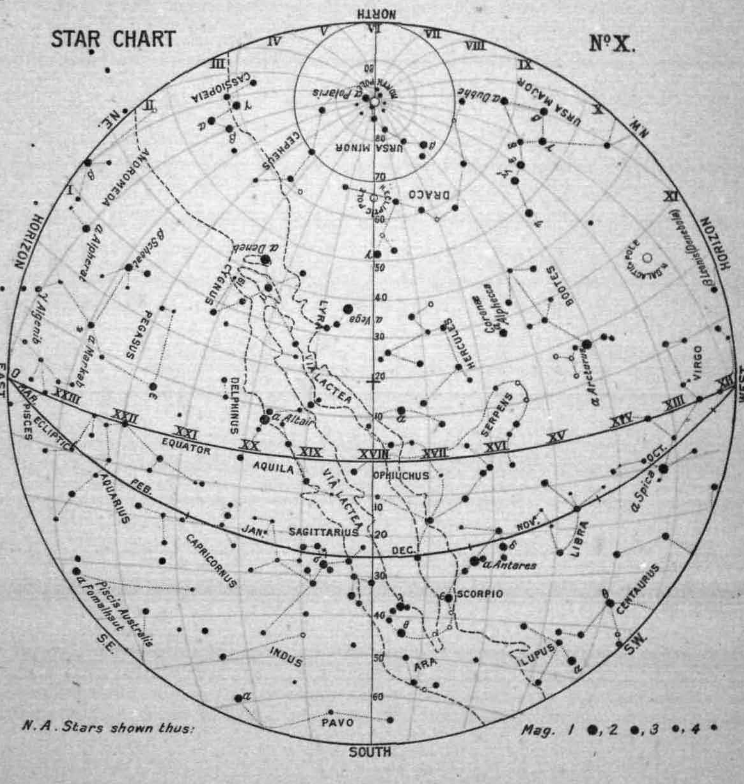
AUGUST



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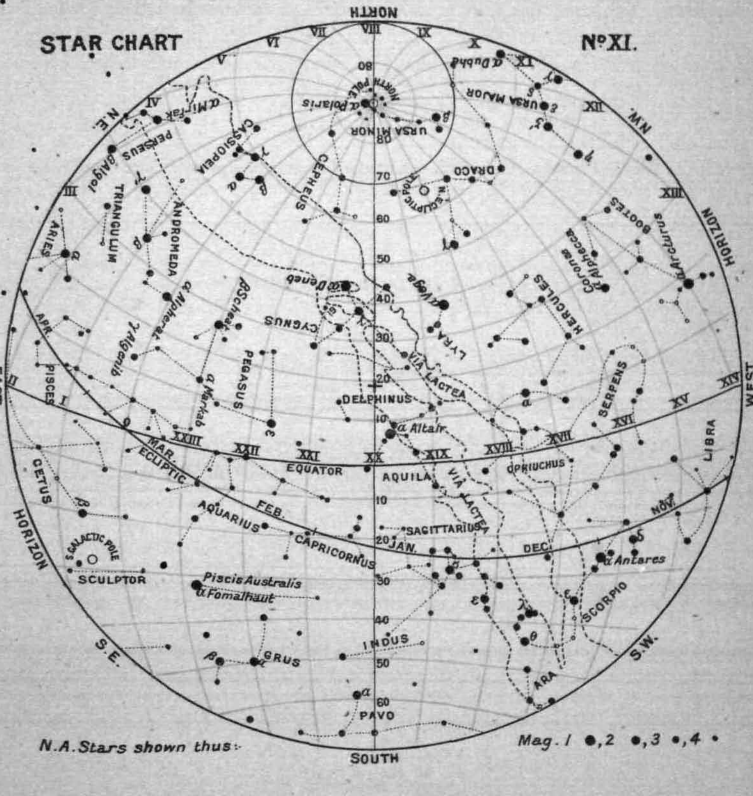
SEPTEMBER



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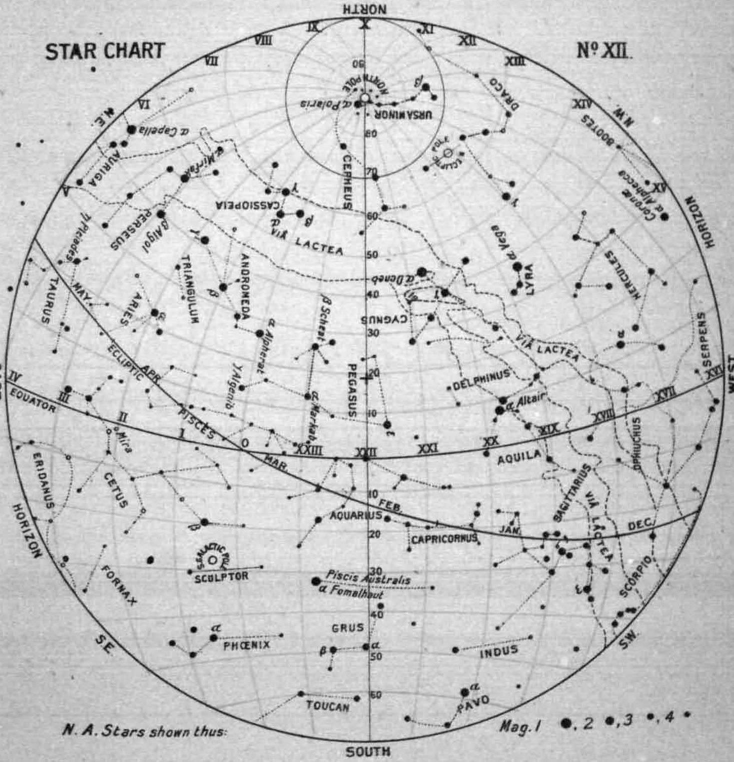
OCTOBER

STAR CHART Nº XII.



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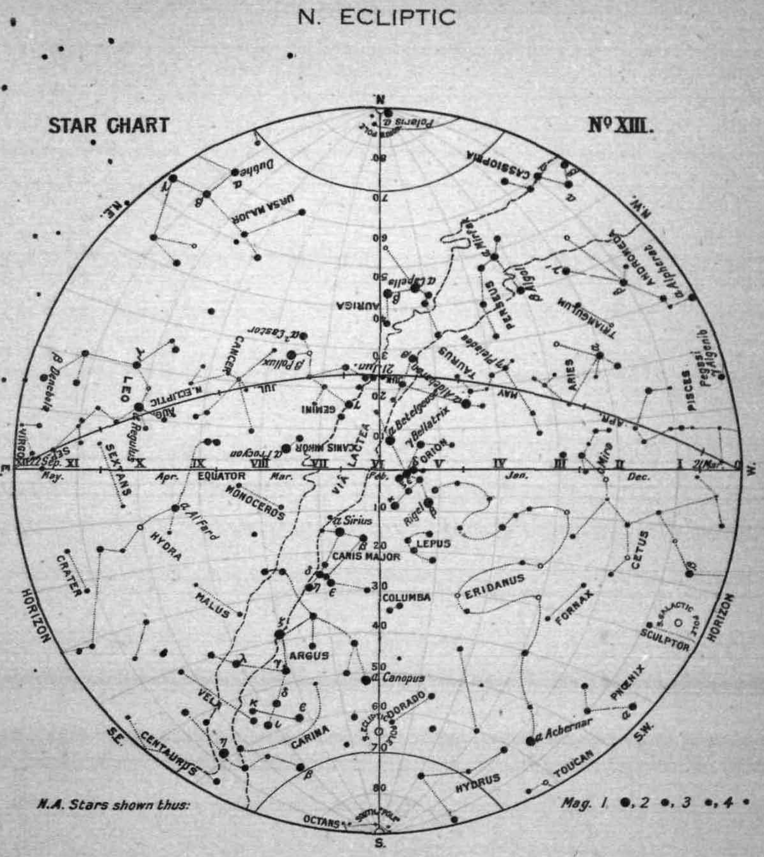
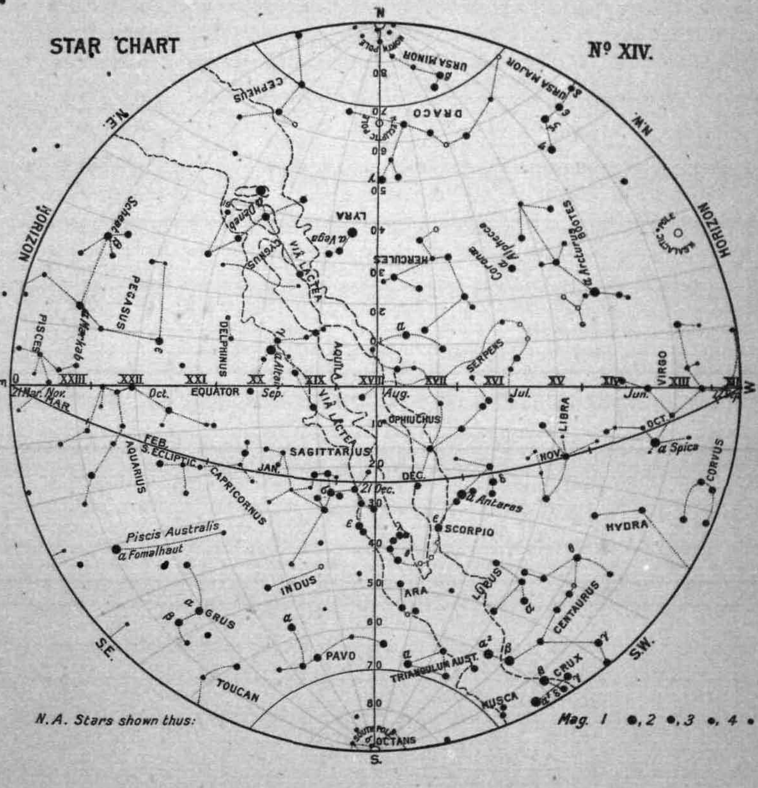


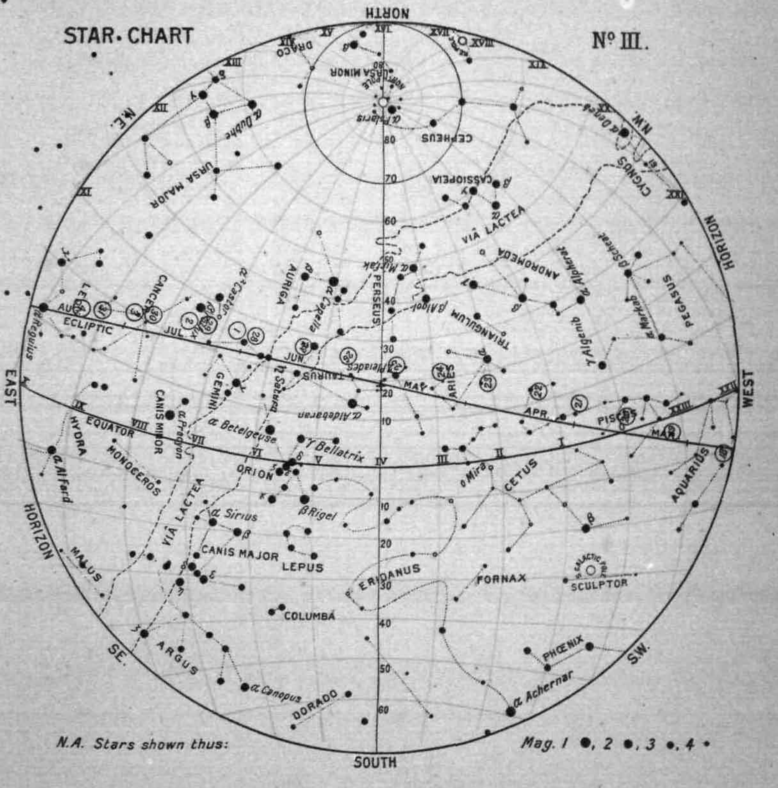
(Feb. 22nd, 7.54 P.M.

S. ECLIPTIC



(Aug. 22nd, 7-59 P.M.)

No. A. JANUARY, 1915



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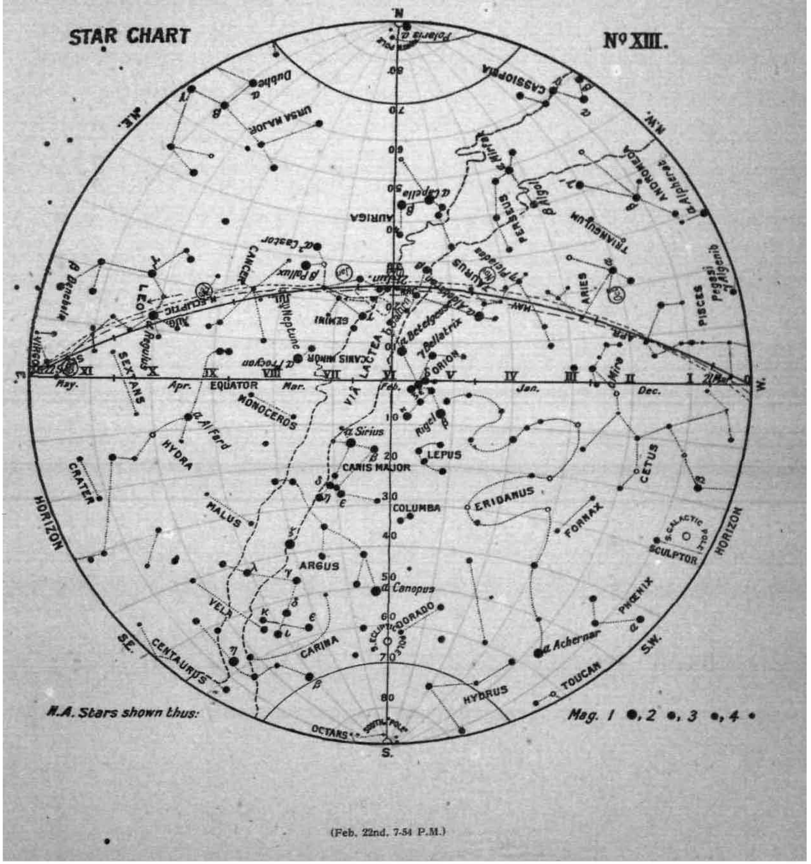
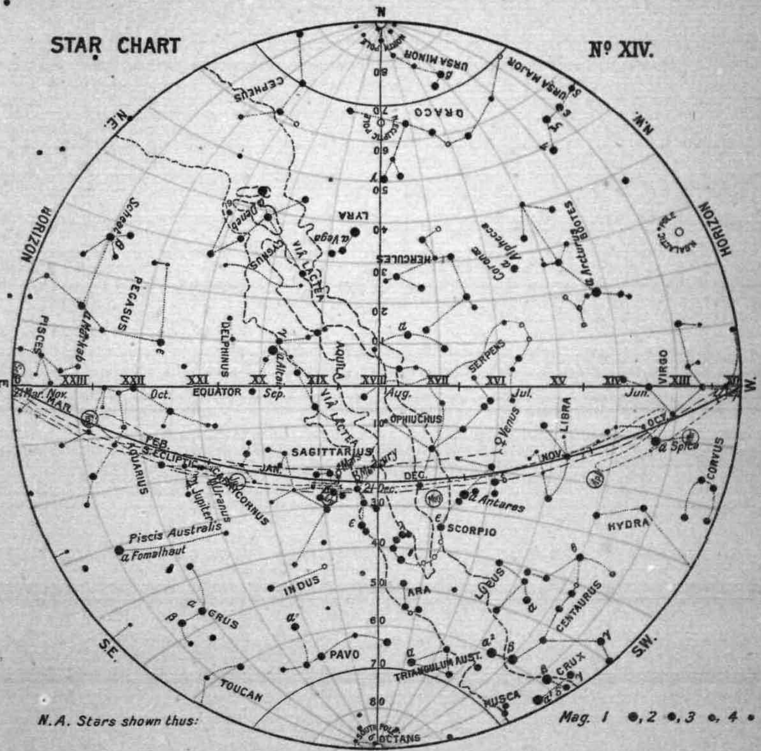


(Feb. 22nd, 7-54 P.M.)

Nº C. S. ECLIPTIC, 1915



(Aug. 22nd, 7-59 P.M.)

APPENDIX

A Tiger Story.

Some 50 years ago, a large, and highly scientific, Great Trigonometrical Survey Party was operating, on triangulation work, on the confines of China, in the northernmost parts of, what was then, British Burma. The country was very mountainous, and the range of hills on the border land was about 5,000 feet above sea-level. Gigantic forests covered the land from top to bottom, and the tracts, particularly in the valleys, were intensely malarious. There were many casualties from malaria among the men, but the inhabitants of those remote and wild regions seemed to be immune from the fever in their native air. Travelling was both dangerous and difficult, for there were no railways in the land at that distant period ; one met mostly primeval forests on all sides.

The population was sparse, and the villages were scattered among the hills and dales. The people were composed of hill-tribes, sturdily built and meagrely clad, and supremely dirty, and having their bodies and limbs profusely tatooed with red or black pigment. They congregated, many families together, in long and low bamboo huts, with roofs, walls, floors, and posts, all of bamboo, which grew abundantly everywhere ; the huts resembled barracks, with a passage through the middle and something like 10 feet divisions along the whole length, each occupied by an entire family. The walls separating these compartments were about a cubit high, so there was not much privacy anywhere. In a word, these simple, good-natured and timorous hill folks were semi-barbarians.

Hill cultivation was practised, known as *taungya*. This consisted of a patch of about 5 acres of annually cleared forest, on which was grown rice, cotton, sessamum, Indian corn, and vegetables. The cultivation was of a shifting character, and temporary huts for the season were erected inside the clearing ; but after the crop was gathered the family returned to their village. These clearings were reverted to every 3 years, on a system of rotation. The only taxes levied were a land-tax, at a nominal rate per *Dah* (large knife used for felling jungle for the cultivation), and a small other rate as a capitation tax. It was a decidedly primitive people, who were assessed in also a primitive way, but eminently suitable to their condition and understanding.

The Survey Party was of full strength, in men and animals. There were 3 Survey Officers, 2 Indian Doctors, a Police and a Burkundaz Guard, each 50 strong, some 500 Kalassis and others, 2 riding elephants (with their *Howdahs*), 20 loading, or baggage, elephants, ponies, etc. The Guard was most necessary, for there was not only treasure to protect, but there was also present the contingency of Chinese marauders who appeared in the neighbourhood of the Camp from time to time, but who did not feel bold enough for a raid. Camps used to be pitched mostly in the valleys, and the greater part of the provisions, except the indigenous rice, which was locally obtained, had to be brought with us from different bases of our own. The cold, at the season of the year (December), was intense ; and at nights there had to be heaters inside

the tents, while fires blazed throughout in different sections of the Camp. In pitching a Camp, it was the practice to tether the elephants at short distances round the encampments, and to have great bonfires between the animals, which, lit in the afternoon, kept ablaze all night. The reason for this was to afford a much needed warmth in the Camp, for the weather was freezing, and to scare away wild beasts. Herds of wild elephants used to roam about, and frequently were attracted towards the Camp by the presence of our tame elephants, but, though within trumpeting distance, they never actually entered our precincts. Tigers were abundant, as also leopards and panthers and the small type of black bears; pig and deer abounded; and there were even rhinos, of both the single and the two-horned varieties, but these were difficult of approach, though we did succeed in bagging one good specimen of the double-horned species.

With this preamble, for the better understanding of the situation, we come to the main purpose of the present narrative. We were, for ourselves, detached off, with a suitable provision of men and material, for a secondary triangulation, emanating from the principal series, for the geographical fixing of an important distant position. After a time, we were located on the back-bone of the high range bordering on China, in the country known as Karenni. Succeeding many exciting experiences and adventures, with some hair-breadth escapes, we descended into a lovely valley where we established our Camp, laid out in the orthodox fashion, prepared for all eventualities. Our own great tent was in the centre of the enclosure, with the Hospital, Guard, and so forth, in the neighbourhood, in their respective quarters. The elephants took up their positions, at intervals, round the Camp, and between them were the usual huge bonfires, for dry logs were readily procurable from the adjoining forests, and, besides our own men, we had hundreds of local coolies (Karens) who helped in the colossal work.

There was a small Karen village near the Camp. The families here, unlike in other parts, lived in separate bamboo huts, raised on piles from 15 to 20 feet from the ground. This was not so much from fear of the malaria, as a way of keeping out of the reach of wild animals at night. Men, women and children, with dogs, cats and poultry, were bound to be all up on the platform of the hut by about 4 o'clock in the afternoon, and the long and narrow portable bamboo ladder, almost perpendicularly placed, leading on to the platform was dragged up after them, so as not to give the unwelcome nocturnal visitors a chance to get near themselves. This was a most necessary precaution. It was a curious sight to see dogs and cats, and even toddling babies, go up and down the steps, a foot apart, of the ladder; but instinct, and the doctrine of self-preservation, teaches wisdom. The cattle, too, were penned in for the night alongside the hut, secure against attack, within a square enclosure strongly built of stout wooden posts, with high unscaleable fences.

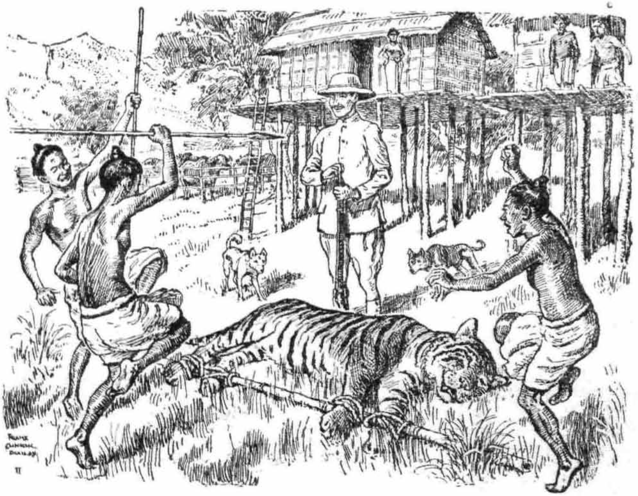
Well, about 4 o'clock in the evening, word, or 'Khubbur,' to use the recognized sporting term, was brought to us from the village that a tiger, which committed considerable depredations in the neighbourhood, and was thus much feared, was at that very moment coming leisurely down the slope of the hill towards the village. The headman himself, with some of his

followers, came with the news. We ourselves possessed a sporting .577 Snider Rifle, with which we had done much damage to game, and which was a deadly weapon, the large and conical, and withal hollow, bullet exploding, on impact, with terrific force. We at once followed these men, half a dozen in number, who were armed with spears and *dahs*. We were soon at the foot of the hill, close to the village, when we observed Stripes coming slowly down the grassy slope, but with his head well up scanning the country ahead, so that we were unobserved. We would by now have been but 100 yards from the animal, when, raising the rifle, and taking a steady and sure aim, we lodged the ball in the centre of the skull, which acted like a shell, bringing the beast to the ground instantaneously, where it dropped dead as mutton. *See* Fig. I.

I.—The Encounter.

We were soon at the spot, and there was much rejoicing among these men, who quickly cut a stout branch from a tree, stripped off some of the bark from the adjoining shrubs, and tied the beast up by the legs to the pole ready to be carried away. The animal, which turned out to be a huge tigress, was brought to the foot of the hill, by the village, when it was laid on the ground, and a kind of war-dance indulged in round the carcase; for the animal had been the terror of the place. *See* Fig. II.

II.—THE WAR-DANCE.



The burden was then conveyed to our tent where it was deposited close by, and was soon surrounded by the men of the Camp, as also villagers, both young and old. This would have been about 5 p.m. We happened to have in our Interpreter, a Zerbaddi Mussulman, half Indian and half Burmese, who was a skilled Taxidermist, and who did a lot of skinning for us of rare birds we collected gratuitously for a celebrated naturalist of Upper India. Within an hour he had neatly skinned the beast, and, with the claws on, had stretched out the skin, by means of sharp-pointed bamboo pegs, at an angle of the tent. Some of the flesh was cut up in morsels, which many of the Hindu followers were glad to receive, to suspend, when dry, round the necks of their little ones, so as to make them, they asserted, as brave as the tiger! For some hours after interest in the evening's kill continued, and stories round the fire near by were told that would even throw the then great event in the shade. Gradually the men dispersed, and we, too, went into our tent; but it was not till midnight that we flung ourself into our virtuous camp-cot. *See* Fig. III.

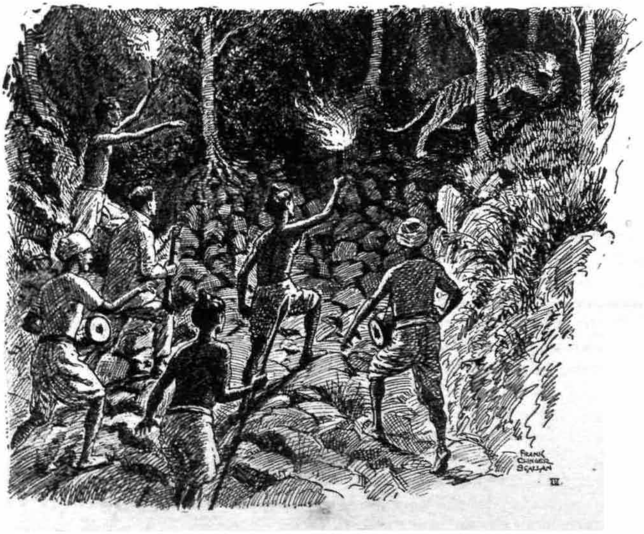
III.—The Skinning.

There was a hanging oil-lamp swinging from the centre of the tent, which gave out a dim light. We were too excited to sleep, for this was our first bag of a tiger, and kept half awake dreaming, as is natural in one's youthful days, of what we should do about the final curing of the skin, and sending it Home to our people, and how proud they would feel of our accomplishment, and so on. By now it would have gone on to 2 o'clock in the morning, for the hours were regularly struck at the Guard. We had two sentries, one at either of our tent doors, a Policeman and a Burkundaz. Just then one of these men lifted the purdah of the door on his side and stood at the entrance. We observed this, and enquired as to what the matter was. The man seemed to be speechless, and his teeth were chattering, apparently from fright. On this, the other sentry came in from his side, and explained that another *bagh* (tiger) had forced its way inside the Camp and carried off the skin of its mate, which had been spread out to dry by the tent. We scarcely credited what we heard, but on hearing the elephants trumpeting we suspected that something unusual must have happened. So we hastily took a hand-lamp and went out of the tent to see for ourselves, and, sure enough, the skin had vanished. As, owing to the cold, there were several small fires in the Camp at which the Indians were warming their toes, and having their *chillum* (smoke); and these men confirmed the story of the

sentry, and declared that the second tiger had come into the Camp from the hill-side, and taken away the skin by the route that it came; and that the elephants were trumpeting in consequence.

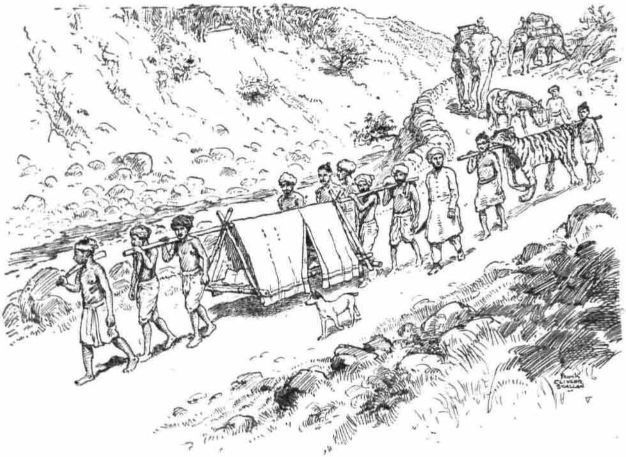
Collecting some of the men, who took torches to light our way, for the Moon though still up was not over-bright, and drums (*Dholuks*) to beat so as to make a noise with, as also spears, or javelins, and *dahs*, and arming ourselves with our trusty rifle, we followed in the wake of the vanishing beast, which was the male that had dared all, and risked all, to get to its pair, to which the scent had brought it. The beast had gone up the dry bed of a hill-stream, and we followed this course for a distance of a couple of miles, making all the noise we could, with our throats and our tom-toms. This had the effect of frightening the animal, which dropped the skin that it was holding in its mouth, and we thereupon secured the precious trophy and returned to Camp by about 4 a.m. The skin was duly stretched out in its place on the ground by the tent once again. *See* Fig. IV.

IV.—The Mate's Love.



Next day, we had to shift to a new camping ground. But with the immense excitement of the day before, and, no doubt, the malaria of the tract, we got into a raging fever. We became delirious, and our Indian Doctor was most attentive; but the best course, under the circumstances, was to proceed in all haste to the nearest Civil Station, which was 100 miles off. And as our big Camp could but move at 10 miles a day, in the hilly and roadless country in which we were, with great boulders to be manipulated over most of the roadway, it took 10 days before getting to our destination. Meantime, we continued unconscious for the most part. But on reaching the Civil Station we were overpowered with kindness from all sides—the Civil Surgeon, the Deputy Commissioner, the Officer Commanding the Station, the Superintendent of Police, and the good ladies of the place were continually over to see us at the Circuit House, and comfort us in many ways, dainty fingers providing an abundance of palatable delicacies and choice and fragrant flowers under the combined weight of which our modest bed-side tea-table literally groaned. The amiable Doctor was more than attentive, and his pronounced skill in a short time brought us completely round, and we were soon on our feet once again. After partaking of the hospitality of these generous friends for some 10 days, we left for one of the neighbouring G. T. Hill Stations, on a wire from our worthy General, who loved us as his own boys, in order to recruit our shattered health. In those far-off and good old days a Surveyor was a *Sahib*, and the Supreme Chief was a real ***Burra Sahib!*** After a month's rest and pure mountain air, we were completely restored to health, and continued our further triangulation work till the end of the open-season. The only regret we carried away with us, which formed the fly in the ointment, was the thought of the loss of the claws from the tiger-skin, all of which were surreptitiously removed from the skin, at the time of our helpless condition when down with that terrific fever of the jungles, and never restored to us; so that the skin, which was a perfect specimen, after being properly cured, was presented to a dear old patriarchal friend (long since gone to his everlasting rest) of our own Service. The culprit, we had a shrewd suspicion, though, was that Artful Dodger of an Interpreter. We must not omit to mention, before we conclude, our faithful friends, who went through thick and thin with us, during the whole of the trying field-season. They are quite inadequately, it may be noted, shown as taking part in the picture of the gloomy procession which conveyed us to the Civil Station. Abdul Rahim, the able Doctor, Ned, the sturdy Pony, Mothi, the gentle Riding Elephant, and Gyp, our loyal Terrier. All these one-time boon companions have, too, long ere this, gone the way of all flesh. All life, one reflects, passes away here below, and we poor mortals with it! Heaven alone endures! *See* **Fig. V.**

V.—The Finale.



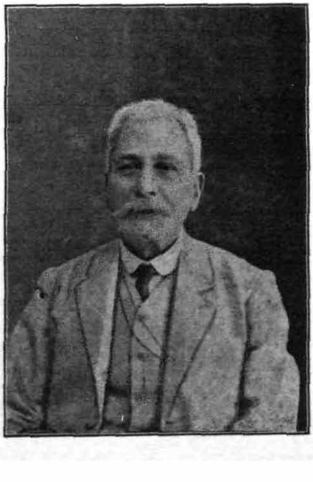
This ends the story of the Tiger, from which there springs much thought for contem plation. The event chronicled shows what strong affection exists amongst animals, and from that fact even human beings might usefully learn a lesson! The story, though old in regard to the time of its occurrence, is new in the telling, for it has never been communicated to any sporting Paper, although these would have been but too glad to have got it for copy; and the subject of it forms but one of many such episodes in our varied life and chequered career. However, it is better told even at this late stage than never; for the teller, too, is going on in years, having already reached the allotted span, and may not have the chance, later on, to accomplish the record. Even 'Le Tigre' (Clemenceau), with his but recent experience of tiger-shooting in India, in his country-seat in the Pine Forests by the Gironde, in sight of the Bay of Biscay, would scarcely have such a thrilling, and unique narrative to relate. The *Shikari* (Hunter) himself, as he now is, appears in Fig. VI. *Vale!*

En passant, it may prove of interest to know that we two Brothers, with the two Fayrer Brothers, all of whom are still in the flesh, were boys together and among the handful of survivors of the gallant little Lucknow Garrison, which was relieved by Havelock's brave Force in the Indian Mutiny of 1857. And it may even be worth narrating that, engaged as we now are

on a flying visit to India, from the Emerald Isle, we have revisited the scenes of our childhood of some 3½-score years ago; and in so doing have had vividly brought back to our mind the horrors of that terrible period of siege, more especially when we descended, with our Indian Guide (himself one of the lads of the Garrison), into the underground ***Thaikhana*** (where we were lodged, women and children) of the Residency, in which the noble Sir Henry Lawrence and our own worthy ancestor, *notre père*, were killed in action within a couple of days of each other, the latter (the Assistant) preceding the former (the Chief), and being, in fact, the first European to lay down his life in the defence of the Bailyguard; both these heroes lie buried, close together, in the sacred grounds of that renowned place. The fate that befel unfortunate Cawnpore, through the treachery of Nana Sahib, awaited Lucknow also, but Providence, in His infinite mercy, disposed otherwise; and we have, thus, been enabled to record the preceding incident, although trivial in character, yet forming part of a series of famous events that are matter of history.

With this *apologia*, we bid the patient reader adieu.

VI.—The Shikari.



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